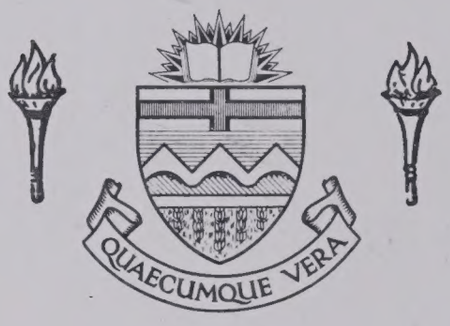

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THE ABILITY OF KINDERGARTEN CHILDREN TO DISCRIMINATE SELECTED VOWEL AND SEMIVOWEL SPEECH SOUNDS

BY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "The Ability of Kindergarten Children to Discriminate Selected Vowel and Semivowel Speech Sounds" submitted by John Gordon Moffatt in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

A major concern of educators is that of teaching children to become effective and efficient readers. One of the most important steps in the process of reading is perception. If a child is to learn to read well his auditory perception of speech sounds must be accurate, necessitating the ability to discriminate among these sounds.

The purpose of this study was to examine the ability of kindergarten children to discriminate selected vowel and semivowel speech sounds which form the syllable nuclei of words. Information was also sought regarding the specific strengths and weaknesses which children showed in their discrimination of these selected syllable nuclei speech sounds.

The sixty children in the test sample were selected from four kindergartens which served different socio-economic areas in the city of Edmonton, Alberta. Thirty boys and thirty girls were randomly selected to form the test sample.

All children in the test sample received an auditory acuity screening test, an intelligence test, and an auditory discrimination test. A Zenith audiometer was used for the audiometric test. The California Short-Form Test of Mental Maturity (Level O) was used as a measure of mental maturity. Auditory discrimination ability was tested by an instrument

constructed by the investigator entitled The Vowel and Semivowel Auditory Discrimination Test.

Data from the study were analyzed using item analyses, computations of correlation coefficients, and analyses of variance.

The findings showed that most kindergarten age children have some difficulty discriminating among the selected syllable nuclei speech sounds as tested by The Vowel and Semivowel Auditory Discrimination Test. A low but significant positive correlation was found to exist between mental age and auditory discrimination ability. There was no significant difference in the auditory discrimination ability between the boys and girls in the test sample. Between high and low auditory discrimination ability groups there was a significant difference in their scores on subtests measuring the ability to discriminate speech sounds in different positions in words, like and unlike word-pairs, "easy" and "hard" word-pairs, various tongue position and tongue height contrasts, and all but two complex syllable nuclei speech sound contrasts.

On the basis of the findings in this study it appears that kindergarten children have some difficulty discriminating syllable nuclei speech sounds. The study suggests several factors that may be operating to affect this discrimination ability. Implications for educators and suggestions for researchers are discussed.

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STATEMENT OF THE PROBLEM

Many skills are involved in the reading process. Two of these are the ability to see letter differences in printed words and the ability to hear separate sounds in spoken words. The child who cannot associate visual symbols with their corresponding sounds will be faced with many difficulties in word perception when he begins to read.

The significance of word perception in the reading process cannot be overemphasized. According to Gray (1960), an educator, the four major components of the reading process, when a good reader reads, are: word perception, comprehension of ideas, reaction to these ideas, and integration of the ideas. Although word perception is only one of four main components of the reading process, it is a most significant part. Gray (1960:13) states:

> Word perception is the all important base of the reading process. We cannot expect children or adults to comprehend, react to, or be influenced by the ideas of any author if they are unable to identify the printed words which convey the ideas.

Significance of Auditory Discrimination in Word Perception

The process of reading involves the recoding of printed or written symbols into sound symbols and abstracting

meaning from those written symbols. In order to associate sound symbols with their grapheme counterparts, the individual must hear the sounds in the words. He must be able to discriminate among speech sounds.

Vernon (1958:58) contends that the ability to pronounce words containing a given phonetic sound, and to blend sounds into words are important for success in reading. In order to maximize success in learning to read, Gray (1960:33) suggests that children should be able to hear a specific sound accurately and be able to produce this sound in their own speech before being asked to associate the same sound with printed symbols. It would appear from what Vernon (1958:58), and Gray (1960:33) have said that the auditory discrimination ability of children at the end of kindergarten is an important factor in their success in learning to read when they enter school the following year.

Significance of Vowels in Auditory Discrimination

In discussing the major difficulties with consonants which had affected the sixty children in her test sample, Fast (1968:121) concluded that the type of sound, position of the sound, the voicing, and the environment of the phoneme all play a part in the discriminability of a particular speech sound. The subject of environment of the phoneme was more directly dealt with by Cosens (1968:121) when it was suggested that the particular vowel before or

following the consonant of interest may have affected discrimination.

Hall mentions that "vowel sounds are responsible for the carrying power of the voice" (1962:12). On the basis of studies by Fletcher, Harris, and Sherman, Klumpp (1964:3) supports this view when he states that "consonant perception is dependent, in part, upon momentary perturbations induced in adjacent speech sounds." Klumpp contends that the significant acoustical characteristics of some consonants cannot be specified adequately without taking into account changes induced in adjacent vowel formants.

Possible Difficulties in Auditory Discrimination of Vowels

Working on the assumption that sounds which children articulate correctly must have been correctly discriminated auditorially, Fast (1968) and Cosens (1968) based their auditory discimination studies on the articulation study by Templin (1957). Since Templin (1957) found that all vowels and diphthongs were articulated correctly by 95 per cent of her sample by age six, comparisons among vowels were excluded from the Fast-Cosens Auditory Discrimination Test.

Although Fast (1968) and Cosens (1968) chose to exclude vowels from their instrument, specialists who work with children with reading problems continue to include

vowel sounds in their materials. Wepman has continued to retain vowel sounds on the Wepman Auditory Discrimination Test. In addition, Hegge and Kirk include many exercises on vowels in the Remedial Reading Drills. If vowel sounds are not responsible for some difficulties in auditory discrimination and oral reading, one might question why clinicians such as Wepman, Hegge, and Kirk have chosen to include remedial exercises on vowels in their materials. Furthermore, teachers at the kindergarten and primary levels have indicated that students do appear to be having some difficulty auditorially discriminating vowel sounds in words.

Gleason (1961:28) states that at the center of every syllable lies a syllable nucleus consisting of a vowel, or a vowel and a following semivowel. It seems reasonable to assume that, if a child has difficulty with the nucleus of a syllable he will have difficulty with the entire word within which the nucleus lies. Because of the central importance of vowels and semivowels in syllable nuclei, a study of the ability of children to auditorially discriminate vowels and semivowels seems justified.

PURPOSE OF THE STUDY

It was the purpose of the study to investigate the discrimination of selected vowel and semivowel speech sounds by children who are completing their kindergarten year,

prior to beginning first grade the following term.

DEFINITIONS

For the purpose of this study, terms are defined as follows:

Auditory discrimination refers to the ability of pupils to hear likenesses and differences in speech sounds in words on The Vowel and Semivowel Auditory Discrimination Test.

Kindergarten refers to a group of preschool children who are receiving instruction as set out in the Kindergarten Manual, Department of Education, Government of Alberta.

Mental age refers to the measurement of the mental level of an individual at this point in time. The instrument of measurement was the California Short Form Test of Mental Maturity, (Level O).

Fricatives refers to the speech sounds /f,v,th,s, sh/ as they are used in the Oberg (1970) study.

Syllable nucleus refers to a vowel, or a vowel and a following semivowel in a word.

Vowel refers to a sound produced with vibration of the vocal cords, by unobstructed passage of air through the oral cavity, and not constricted enough to cause audible friction. The vowel sounds examined in this study are /i, e, œ, ə, a, u, and ɔ/ as in ⟨bit, bet, bat, but,

bought, put, and ball⟩.

Semivowel refers to a sound produced with some vibration of the vocal cords. This friction is less than that which occurs during the production of a consonant sound but more than that which occurs during the production of a vowel sound. The semivowel speech sounds which are examined in this study are /y/ and /w/ as in ⟨bite and bout⟩.

HYPOTHESES

(1) Between kindergarten children high in auditory discrimination ability, and low in auditory discrimination ability, as measured by the total test scores on The Vowel and Semivowel Auditory Discrimination Test, there will be no significant difference in their:

(a) subtest scores on items measuring sounds in the initial, medial, and final positions in words;

(b) subtest scores on items measuring like and unlike word-pairs;

(c) subtest scores on items measuring "hard" and "easy" word-pairs;

(d) subtest scores on test items measuring the following sound type contrasts of simple syllable nuclei in words:

(i) front-central tongue position contrasts;

(ii) central-back tongue position contrasts;

(iii) front-back tongue position contrasts;

(iv) high-mid tongue height contrasts;

(v) mid-low tongue height contrasts;

(vi) high-low tongue height contrasts;

(e) subtest scores on test items measuring the following speech sound contrasts of complex syllable nuclei in words:

(i) /iy/ - /ey/ as in ⟨beat - bait⟩;

(ii) /iy/ - /ay/ as in ⟨beat - bite⟩;

(iii) /ey/ - /ay/ as in ⟨bait - bite⟩;

(iv) /ow/ - /aw/ as in ⟨boat - bout⟩;

(v) /aw/ - /uw/ as in ⟨bout - boot⟩;

(vi) /ow/ - /uw/ as in ⟨boat - boot⟩;

(2) There will be no significant correlation between the ability of kindergarten children to auditorially discriminate selected vowels and semivowels in words, as measured by The Vowel and Semivowel Auditory Discrimination Test, and the following variables:

(a) mental age in months;

(b) chronological age in months.

(3) In analyzing total auditory discrimination scores on The Vowel and Semivowel Auditory Discrimination Test there will be no significant difference between the scores of the boys and the scores of the girls.

OVERVIEW OF THE STUDY

The test sample consisted of sixty kindergarten children randomly selected from four kindergartens chosen by the investigator in consultation with school officials in Edmonton, Alberta. Ten boys and ten girls were chosen from each of the high, middle, and two low socio-economic status groups of students during the first week of May, 1970.

An auditory acuity test using the Zenith audiometer was administered to each subject in order to eliminate any children with below normal auditory acuity from the study.

A measure of the mental age of each subject was obtained through the administration of the California Short-Form Test of Mental Maturity (Level O) to small groups of students during the second week of May, 1970.

The Vowel and Semivowel Auditory Discrimination Test was constructed by the investigator. This test was used to measure the ability of the subjects to accurately auditorially discriminate between pairs of words which differed by only a single phoneme.

The data obtained during the study were analyzed in several ways using the computer services department at the University of Alberta. An item analysis, computations of correlation coefficients, and an analysis of variance were performed. For the purposes of this study a probability level of .05 for a two-tailed test was adopted.

LIMITATIONS OF THE STUDY

In this study the phonological environment of sounds is not being investigated. Calfee and Venesky (1968:106) have suggested that consonant sounds interacting with vowel sounds may play an important part in determining whether or not an individual can auditorially discriminate words in a minimal pair.

SIGNIFICANCE OF THE STUDY

If, as educators like Gray (1960:13) have suggested, good readers go through the process of word perception, comprehension of ideas, reaction to these ideas, and integration of the ideas while reading, it seems reasonable to assume that the initial processes involved in word perception are of basic importance. As Durrell (1954:203) has suggested, because the beginning reader must learn to make phoneme-grapheme associations, the accuracy with which he hears speech sounds and learns to differentiate among them will directly affect his success in learning to read.

The results of previous studies in articulation (Templin, 1957), and auditory discrimination (Miller and Nicely, 1966) have led theorists to assume that children should be able to auditorially discriminate the various vowel sounds by the time they begin school in grade one (Olmstead, 1966:531). As a result, the efforts of researchers and educators have largely focused on the

auditory discrimination of consonant speech sounds rather than on vowel speech sounds.

Notwithstanding the fact that children beginning first grade may frequently experience difficulty with the auditory discrimination of consonants, they may also experience some difficulty with vowel speech sounds.

This study was undertaken in an effort to determine the effect of selected syllable nuclei on the auditory discriminability of minimal word-pairs. It is hoped that information regarding the significance of syllable nuclei in the auditory discrimination ability of kindergarten children may assist teachers in developing auditory readiness programs to assist in the teaching of reading both in the developmental and the remedial areas. In addition, the information gathered as a result of this study may provide worthwhile content for teacher education in the area of reading. Content on auditory discrimination, as a word recognition skill, would seem to be an essential part of any university or in-service program designed to improve the teaching of reading.

CHAPTER II

REVIEW OF RELATED LITERATURE

This chapter will indicate the significance of auditory discrimination as a skill necessary to become an effective and efficient reader. In order to systematically examine literature in the area, the research will be reviewed in several sections. Section one reports on research relating auditory discrimination and achievement in reading, while sections two, three, four, and five examine in turn the relationships of socio-economic status, sex, intelligence, and chronological age, to ability in auditory discrimination. A summary of the chapter will follow section five.

In order to minimize unnecessary repetition, the full names of tests will be used only when they are first referred to. Any subsequent reference to the same test will be by an abbreviated name only. Background data on the various studies quoted in this chapter will be given during the first reference. Any subsequent reference to the same study will not contain a repetition of that information.

Auditory Discrimination and Reading Achievement

Many studies have shown that children who do well in reading have the ability to accurately auditorially discriminate sounds. Conversely many children who display

weakness in reading are also found to have poor auditory discrimination ability.

Auditory Discrimination and Reading Difficulty

Monroe (1939) has suggested that reading achievement may be impeded by poor auditory discrimination ability. She constructed a "word-pairs" test which consisted of twenty items. Some pairs consisted of words of identical sound while other pairs contained words which differed only in one phonemic element.

In this study the auditory discrimination ability of a group of thirty-two randomly selected grade one students was compared with the auditory discrimination ability of a group of thirty-two grade one children who could not read. As a result of this study, Monroe (1939:95) concluded that:

> Lack of precise auditory discrimination was found to impede the learning which involves auditory impressions. The lack of auditory discrimination of certain sounds may lead to a confusion of words which in turn affects speech, or reading, or both.

Ewers (1950) conducted a study which sought to determine relationships between reading difficulties and auditory defects. Her sample consisted of 140 high school students who formed a homogeneous group with regard to cultural background although its members differed with regard to religion, language, and sex. To the sample of students, Ewers administered two reading tests, the

advanced test from the Iowa Silent Reading Tests and the Standardized Oral Reading Paragraphs by Gray, as well as forty-three auditory tests.

The results of Ewers (1950) study appeared to indicate that good reading ability involves:

(1) reacting discriminately to very short speech and non-speech stimuli;

(2) selecting particular sounds from within a framework of sounds;

(3) closing the gaps between sounds;

(4) discriminating between pure tone frequencies;

(5) detecting varying degrees of loudness; and

(6) knowing the large melodic pattern of sound of the American language (1950:259).

Auditory Discrimination and Successful Reading

Reynolds (1953) conducted a study of 188 grade four pupils who had been randomly selected. Reynolds administered several reading ability and auditory ability tests to the children in his sample. Using the Gates Basic Reading Tests, types A and D, Form I, as measures of general reading ability, the investigator found that auditory blending ability was not related to general reading ability but was slightly related to skill in word recognition. Using a fifty-item word-pairs test for auditory discrimination, Reynolds found that ability to auditorially discriminate among various speech sounds was highly

correlated with all aspects of reading achievement.

An extensive correlational study undertaken by Wheeler and Wheeler (1954) has also investigated the relationship between auditory discrimination ability and achievement in reading. Reading ability was measured by the Metropolitan Achievement Tests, Elementary and Intermediate, Form R, while auditory discrimination ability was tested using an instrument constructed by the investigators. The auditory discrimination instrument, which was administered to 629 children in grades four, five, and six, included items which tested:

(1) discrimination between word pairs;

(2) discrimination between pairs of sound elements;

(3) discrimination of final blends, using rhyming words; and,

(4) discrimination of sounds within words.

The results of the Wheeler and Wheeler (1954) study indicate that auditory discrimination ability was significantly related to reading achievement.

Reid (1962) has examined the relationship between auditory discrimination ability and reading achievement of grade one pupils. She examined the auditory abilities of 112 children using the Auditory Fusion Test from the Betts Ready to Read Tests, and the Wepman Auditory Discrimination Test, Form A. The results of Reid's study indicated that auditory discrimination ability was significantly related to

ability in oral reading and ability in word recognition. As a result of the outcome of her study, Reid concluded that educators must give consideration to auditory discrimination ability as a factor in determining the potential of a beginning reader to succeed in becoming a good reader.

Although she acknowledged selective sampling as a limitation of her study, Reid felt that the large size of the school from which the sample was drawn allowed for a statistically satisfactory procedure.

As a result of her study, Reid may be in a position to question the teaching procedures for initial reading instruction as laid out in the manual of the reading series. Conclusions of this study tend to imply that for some children, the use of phonics in learning to read should be postponed until adequate auditory discrimination ability will allow for profitable instruction.

Another study which has focused on the relationship between auditory discrimination and reading achievement in the early school years is that of Dykstra (1966). To his sample of 632 randomly selected grade one children, Dykstra administered seven selected measures of auditory discrimination, and two selected measures of reading ability.

The auditory discrimination instruments, as given to the high, middle, and low socio-economic status children in the sample, gave consideration to the following areas:

(1) initial consonants in word pairs;

(2) final consonants in word pairs;

(3) rhyming; and

(4) auditory blending.

Correlations were obtained between the various auditory discrimination instrument scores, and the scores obtained on the measures of reading achievement. From this Dykstra concluded that four of the seven auditory discrimination measures were significantly related to reading achievement. The four significant areas were:

(1) rhyming, as measured by the Gates Rhyming Test;

(2) auditory-discriminations, as measured by the Harrison-Stroud Test;

(3) discrimination of ending sounds, as measured by the Murphy-Durrell Discrimination Test; and

(4) use of context and auditory clues, as measured by the Harrison-Stroud Test.

As a result of his study, Dykstra (1966:32) concluded that the fact that a majority of the measures were significantly related to the two measures of reading achievement, indicated that auditory discrimination ability may contribute to success in learning to read.

Dykstra has carried out a very well planned and reported study. By using a large number of students in his sample Dykstra has lent more validity to the generalizations he makes as a result of his research. By

using children from all socio-economic levels, Dykstra has provided for a range in language experience to be represented in his sample. Finally, the use of a number of different measures of auditory discrimination and reading ability has allowed Dykstra to examine several different aspects and approaches to testing in these areas.

Wepman (1960), in a study using 156 first and second grade children sought to investigate the relationship between auditory discrimination ability as measured by his test, and reading achievement as measured by the total score on the Chicago Reading Tests. The measures, which were administered at the end of the school year, showed a positive relationship between auditory discrimination ability, and reading achievement. On the basis of this study, as well as previous clinical experience, Wepman (1960:331) states:

> The significant relation between discrimination and reading, especially in the lower grades, was expected since phonics plays such an important role at this level.

Poling, in a study completed in 1968, attempted to determine the relationship between auditory discrimination ability and reading achievement for pupils in the first and second grade. This was a longitudinal study in which 137 children were given the two forms of the Wepman test, the Chicago Reading Tests, and the Gilmore Reading Test at various times during the first and second grades.

Poling (1968) found a greater relationship between

reading achievement, auditory discrimination, and intelligence at the second grade level than at the first grade level.

As a result of her study, Poling (1968) suggests that, in general, children with good auditory discrimination and above average mental age can be expected to become superior readers, and those children with poor auditory discrimination and average mental age to become average, or poor readers.

Poling's (1968) test sample was drawn from a small suburban area outside of Chicago and, as a result, it would be difficult to make generalizations to a middle class population. Poling (1968) did not note the instructional procedures used with her test sample. One wonders if auditory discrimination developed through specific training, or incidentally as a result of maturation.

Cosens (1968) attempted to determine the relationship between auditory discrimination ability, as measured by the 266 item Fast-Cosens Auditory Discrimination Test, and reading ability, as measured by the Gray Oral Reading Tests and the Lee-Clark Reading Test, First Reader, Forms A and B. Although the results of this study indicated that auditory discrimination training near the end of the first grade did not improve the reading achievement of pupils low in auditory discrimination, the correlations between silent reading and auditory discrimination scores were significant,

thus suggesting that auditory training earlier in the grade one year might result in improved silent reading scores (1968:iv).

Summary

The studies described have indicated the significance of auditory discrimination as an important factor which may influence a child's success in becoming a good reader. Research has indicated that poor readers tend to be weak in the ability to auditorially discriminate speech sounds. The relationship between auditory discrimination ability and reading achievement suggests that it may be worthwhile including auditory perceptual training as part of the regular reading program.

The importance of auditory discrimination ability to success in reading has been shown. It therefore seemed worthwhile to select a test population at the kindergarten level where implications from this study might be applied to an auditory readiness program designed to precede instruction in reading during the first year of school.

AUDITORY DISCRIMINATION AND SOCIO-ECONOMIC STATUS

If auditory discrimination is related to language ability, and language ability is related to socio-economic status, then one might assume that a relationship would exist between auditory discrimination ability and socio-economic status. Studies have shown a positive correlation

between socio-economic status and ability in auditory discrimination.

Edwards (1965:547) has noted that culturally deprived children display weakness in auditory discrimination ability. He states that there may be a tendency toward perceptual distortion when these children are forced to reconcile "new" sounds with their more familiar speech sound system. As a result of inexperience with the language used in the school situation, the child may be hampered in the development of his word recognition skills because of difficulty making the appropriate sound-letter symbol relationship.

Silberman (1964:38) has suggested that slum children may lack the ability to distinguish very subtle differences and nuances in sound which are essential to success in reading. In other words, they may display weakness in auditory discrimination ability. In support of Silberman's point of view, is Raph (1965:389-397) who, after reviewing studies of language development of low socio-economic status children, concluded:

> . . . the process of language acquisition for socially disadvantaged children, in contrast to that of middle class children, is more subject (a) to a lack of vocal stimulation during infancy, (b) to a paucity of experiences in conversation with more verbally mature adults in the first three or four years of life, (c) to severe limitations in the opportunities to develop mature cognitive behavior, and (d) to the types of emotional encounters which result in the restricting of the children's conceptual and verbal skills (p. 396).

According to Raph (1965: 396-397) lower socio-economic status children display qualities of language which demonstrate a deficit in the auditory-vocal modality, a meagerness of quantity and quality of verbal expression, and a slower rate and lower level of articulatory maturation. If success in reading is dependent on facility with language (Bernstein:164; Armstrong;59), and if facility with language is related to socio-economic background (Raph:396-397), then educators must be aware of the problems faced by the low socio-economic status child as he strives to become a good reader.

Deutsch (1964), in a study which investigated the auditory discrimination ability of low socio-economic status children in grades one, three, and five, administered the Wepman test to each student. As a result of her study Deutsch (1964) concluded:

> . . . it may well be that lower class children, who live in very noisy environments do not develop the requisite auditory discrimination abilities to learn to read well—or adequately—early in their school years (p. 293).

Deutsch (1964:278) states that discriminations come only with experience in responding to the stimuli. This position is further supported by Deutsch (1963) when he postulates that:

> . . . the child learns to be inattentive in the preschool environment. . . . if this trained inattention comes about as a result of his being insufficiently called upon to respond to particular stimuli, then his general level of responsiveness will also be diminished. The

> nature of the total environment and the child-adult interaction is such that reinforcement is too infrequent, and, as a result, the quantity of response is diminished (p. 171).

Clark and Richards (1966:259-262) examined the differences between "economically disadvantaged" and "economically nondisadvantaged" children, with respect to their auditory discrimination ability. The test sample consisted of fifty-eight preschool children, half of whom were classified as "economically disadvantaged", and the other half as "economically non-disadvantaged". The measure of auditory discrimination ability was the Wepman test. The presentation of the test was made from a tape recording which ensured consistency of presentation.

As a result of their investigation, Clark and Richards (1966:261) concluded that preschool "economically disadvantaged" children display significant deficiencies in auditory discrimination ability when they were compared to a "non-disadvantaged" group.

A study conducted by Silvaroli and Wheelock (1966: 247-251) used low socio-economic status children in an attempt to determine whether or not auditory training would improve the ability of beginning readers to auditorially discriminate speech sounds, and whether or not the use of speech sounds in known words, or nonsense syllables makes a difference in auditory discrimination ability. Sixty pupils were randomly selected for each of the experimental and control groups. The experimental group was further

subdivided into two groups, A.D.T. 1 and A.D.T. 2. All groups were pretested on the Wepman, and Harrison-Stroud tests. The investigators presented thirty-three basic speech sounds in known words for the A.D.T. 1 experimental group, and thirty-three speech sounds in nonsense words for the A.D.T. 2 experimental group. After a training period of five weeks the groups received a posttest using the Wepman, and Harrison-Stroud tests once again.

On the basis of their findings Silvaroli and Wheelock (pp. 261-262) concluded that training in auditory discrimination improved the ability of the experimental group to make auditory discriminations among speech sounds. Furthermore, the experimental group did not perform significantly better on speech sounds in known words, or in nonsense words. The results of the study suggested that children from low socio-economic status groups might benefit from an auditory discrimination improvement program.

Mortenson (1967) in a study which investigated the relationship between auditory discrimination ability and socio-economic status, randomly selected 500 first grade children from each of the high, middle, and low socio-economic status groups, thus giving him a total test sample of 1500 subjects. The Duncan Socio-Economic Index Scale was used to classify subjects into socio-economic groups. Three auditory discrimination tests, which measured beginning sounds, ending sounds, and vowel sounds, were

given to each child. The results of Mortenson's (1967) study showed that the higher the socio-economic status of the child, the better he performed on the auditory discrimination tasks.

Fast (1968), in a study completed at the University of Alberta, compared the auditory discrimination ability of grade one children from "low socio-economic areas" with children from "other-than-low socio-economic areas". To her randomly selected sample of 120 children, Fast administered the Fast-Cosens test. After individually testing all 120 students Fast found that the "other-than-low" socio-economic status children performed significantly higher than the "low socio-economic" group although the pattern of errors was the same for both groups. As a result of her research, Fast concluded that the socio-economic status of a first grade child may play a significant role in his ability to discriminate speech sounds.

Summary

Research has suggested that, in situations where a child's verbal interaction has been restricted, weakness in the development of language ability, and ability to discriminate speech sounds may result. Table I summarizes the statements made by the investigators cited in this section.

TABLE I

THE CORRELATION BETWEEN AUDITORY DISCRIMINATION ABILITY AND SOCIO-ECONOMIC STATUS

Sources Cited	Findings	
	Positive	Negative
Edwards (1965)	x	
Silberman (1964)	x	
Raph (1965)	x	
Deutsch, C. (1964)	x	
Deutsch, M. (1963)	x	
Clark and Richards (1966)	x	
Silveroli and Wheeler (1966)	x	
Mortenson (1967)	x	
Fast (1968)	x	

As a result of the findings cited in this section, socio-economic status was controlled by selecting an equal number of children from each of the high, middle, and low socio-economic groups.

AUDITORY DISCRIMINATION AND SEX DIFFERENCES

There has been no complete concensus of research findings regarding the superiority of either sex in auditory discrimination ability. Cardon (1968), in a review of studies concerning sex differences and achievement in reading, states:

> That there is a difference in the academic performance of boys and girls can hardly be questioned. Even the studies that produced

> results that were not significant yielded scores for girls that were consistently higher than the scores for boys (p. 429).

Although auditory discrimination ability has been shown to be an important factor in reading achievement (Monroe, 1939; Reynolds, 1953; Wepman, 1960; Reid, 1962), studies investigating the superiority of either sex in the ability to auditorially discriminate speech sounds have shown a variety of results.

Studies by Reid (1962), Dykstra (1966), and Mortenson (1967) have indicated that girls are significantly superior to boys in auditory discrimination ability.

Reid (1962) found that the girls did significantly better than the boys in her sample during the testing during the beginning of the school term.

Dykstra (1966) analyzed data separately for boys and girls in order to determine the influence of sex differences on the performances on the auditory discrimination tests and on the reading achievement tests. He concluded that "girls were significantly superior to boys in the auditory discrimination skills measured" (pp. 30-31).

Mortenson (1967) conducted a study using a sample of 750 boys, and 750 girls representing high, middle, and low socio-economic status areas. To his total sample of 1500 children, he administered three measures of auditory discrimination ability. Initial consonant speech sound comparisons were tested by having the children discriminate

between pictures which began with similar sounds. A test of vowel speech sounds was made by having the subject respond to a verbal cue by selecting the correct picture. Discrimination among various word endings was made by requiring that the subject designate one picture, from a choice of three pictures, which displayed a word-ending speech sound which was identical to the stimulus picture displayed by the examiner. According to the results of Mortenson's study, beginning grade one girls performed significantly better than the boys on the auditory discrimination tasks at each socio-economic status level.

Cosens (1968) in a study using twenty-seven boys and thirty-three girls indicated that boys were significantly superior to girls on like word-pair items which measured all sound types included in the test instrument. Although boys were significantly superior only on the like word-pair items, the boys were slightly superior to the girls on total auditory discrimination scores as well as the auditory discrimination of all speech sound types (1968: 126).

A number of studies have shown that there is no significant difference in favor of boys, or girls, in auditory discrimination ability (Reid, 1962; Clark and Richards, 1966; Fast, 1968; Poling, 1968; Oberg, 1970).

Reid (1962) obtained conflicting results in her study of 112 first grade children in the city of Edmonton, Alberta. Although girls were significantly superior to

boys during initial testing by the Wepman test during the month of October, the results of retesting near the end of the school year failed to indicate any superiority of significance in favor of boys or girls.

In a study of fifty-eight subjects, Clark and Richards (1966) administered the Wepman test to each child. The results of the research indicated that there was no significant relationship between sex and ability to discriminate speech sounds (p. 261).

Fast (1968), in a study using a test sample of fifty-nine boys and sixty-one girls, found no significant correlation between sex and auditory discrimination ability.

Oberg (1970) with a test sample of eighty boys and eighty girls concluded:

> Although the boys made higher scores than the girls in kindergarten, grade one, and grade two, in grade three the girls' mean score was higher than that of the boys'. . . . there was no significant interaction between grade and sex for the total test sample (p. 142).

Summary

While some studies have demonstrated a significant positive correlation between auditory discrimination and sex, others have not. From the available data it does not appear possible to draw any definite conclusions regarding the superiority of either sex in ability to auditorially discriminate speech sounds. Table II summarizes the findings

of the research cited in this section.

TABLE II

THE RELATIONSHIP BETWEEN AUDITORY DISCRIMINATION AND SEX FINDINGS

Sources Cited	Boys Superior	Girls Superior	No Superiority
Reid (1962)*		x	x
Dykstra (1966)		x	
Mortenson (1967)		x	
Cosens	x		
Clark and Richards (1966)			x
Fast (1968)			x
Oberg (1970)			x

*During initial testing Reid found girls significantly superior to boys, but during a second test administration later in the year, she found no significant differences between sexes.

Because no clear indication of the superiority of either sex is evident, this area appears to be in need of more investigation. In this study sex was controlled by selecting a test sample consisting of an equal number of boys and girls.

AUDITORY DISCRIMINATION AND INTELLIGENCE

Intelligence has been found to be positively correlated with success in auditory discrimination, although the degree of correlation appears to vary from study to study.

Wepman (1960:325-333) conducted a study aimed at comparing auditory discrimination ability and intelligence. To his sample of 156 first grade children, Wepman administered his auditory discrimination test. This word-pairs test consisted of paired comparisons of thirteen initial consonants, four medial vowels, thirteen final consonants, and ten false choice pairs (1960:330). From his study, Wepman obtained a low positive correlation of .32 between auditory discrimination ability and intelligence, as measured by the Kuhlman-Anderson Intelligence Tests. Wepman explained this relationship by suggesting that a child with high intelligence attends to his task better and consequently scores better on an auditory discrimination test.

Thompson (1963:376-378) initiated a longitudinal study using 105 children as they passed through the first two grades of school. The purpose of the Thompson study was to determine the relation of auditory discrimination and intelligence test scores to success in primary reading. The investigator administered the Wepman test, Boston University Speech Sound Discrimination Picture Test, and a modified version of the Auditory Discrimination and Orientation test from the S.R.A. Reading Analysis, Aptitude: Form A. From these tests a composite auditory discrimination score was obtained. Intelligence was measured using the Wechsler Intelligence Scale for Children. As a result

of her study Thompson (1963) concluded:

> From the high intercorrelations of the factors of auditory discrimination and intelligence, it may be concluded that adequacy in the one trait is frequently accompanied by adequacy in the other at the beginning of the first year of school (p. 337).

Six hundred and twenty-nine children were studied in a project carried out by Wheeler and Wheeler (1954: 103-113). The researchers developed an auditory discrimination test designed to test sounds as they are heard in spoken language. Reliability measures for the test, using the split-half technique, were .83 and over. Wheeler and Wheeler (1954:110) obtained positive correlations between .38 and .46 between auditory discrimination test scores, and intelligence. They concluded that "the correlations between the A-D factor and intelligence indicate the possibility of a substantial relationship" (1954:110).

MacAulay, in a study completed at the University of Alberta in 1965, attempted to determine the most effective learning mode for teaching first grade children. In connection with her study, MacAulay (1965) administered the Wepman test and the Pinter-Cunningham Primary Test, as measures of auditory discrimination and intelligence respectively, to her sample of eighty-two children.

After analyzing data from the study MacAulay (1965: 203) found intelligence correlated significantly with auditory discrimination for the total group, and for the boys in the sample.

Fast (1968), using the Fast-Cosens test, and the Lorge-Thorndike Intelligence Test as a measure of intelligence, tested 120 grade one pupils. The investigator found a significant positive correlation between intelligence and auditory discrimination ability with regard to the total group.

Oberg (1970) obtained intelligence scores from the California Short-Form Test of Mental Maturity. Oberg (1970: 143) found that when the total test sample was considered, intelligence was significantly correlated with the childrens' performance on the auditory discrimination test at the .01 level of significance.

Summary

Research has indicated that a positive, although sometimes low, relationship exists between intelligence and auditory discrimination ability. Table III summarizes the findings of the research discussed in this section of the chapter.

TABLE III

THE CORRELATION BETWEEN AUDITORY DISCRIMINATION AND INTELLIGENCE

Sources Cited	Findings	
	Positive Correlation	Negative Correlation
Wepman (1960)	x (low)	
Thompson (1963)	x	
Wheeler and Wheeler (1954)	x (low)	
MacAulay (1965)	x	
Fast (1968)	x	
Oberg (1970)	x	

Because of the inconsistency in the degree of positive correlation between auditory discrimination and intelligence reported in previous research, the correlation between intelligence and ability to auditorially discriminate speech sounds was further probed in this study.

AUDITORY DISCRIMINATION AND CHRONOLOGICAL AGE

Generally there is a positive correlation between auditory discrimination ability and chronological age. Wepman (1960:325-331) carried out a longitudinal investigation of 156 children as they moved through grades one and two. All children were given Form I of the Wepman test at the beginning of the first grade. As the children progressed into grade two they were given Form II of the Wepman test. As a result of comparing scores between the two forms of the test Wepman (1960:331) concluded that the developmental nature of auditory discrimination is demonstrated by the decreasing number of children with auditory discrimination problems at each higher grade and age level.

Thompson (1963:375-378) completed a longitudinal study utilizing 105 children as they moved through grades one and two. A composite auditory discrimination score, from three separate auditory discrimination measures, was arrived at for each pupil on two occasions. The children were first tested immediately prior to beginning grade one,

and were retested during the eighth month of grade two. At the completion of her research, Thompson (1963) stated:

> Inaccurate discriminative ability is more characteristic of first grade entrants than accurate ability. The reverse is true at the end of the second grade (p. 377).

Oberg (1970) studied the developmental nature of auditory discrimination ability of children in kindergarten, grades one, two, and three. Although the investigator noted the limitation of not conducting a pure longitudinal study, the data resulting from this modified longitudinal investigation does contain valuable implications.

Oberg (1970 : 143) correlated the chronological ages of the children in her sample with their scores on the Fast-Cosens test. She found that chronological age was significantly related to auditory discrimination ability at the .01 level of significance.

Although research appears to indicate a positive correlation between chronological age and achievement in auditory discrimination, findings are by no means conclusive.

Dykstra (1966:16) in reviewing research significant to his study, stated that age does not appear to be a factor in determining whether or not skill in auditory discrimination is related to reading achievement.

Summary

Generally research has shown that:

> The development of auditory discrimination appears to be a maturational process; therefore, children develop auditory discrimination skills at different ages (Christine and Christine, 1964: 98).

We must, however, be aware that this is not a unanimous position taken by all researchers. Table IV summarizes the findings cited in this section.

TABLE IV

THE CORRELATION BETWEEN AUDITORY DISCRIMINATION AND CHRONOLOGICAL AGE

Sources Cited	Findings	
	Positive Correlation	Negative Correlation
Wepman (1960)	x	
Thompson (1963)	x	
Oberg (1970)	x	
Dykstra (1966)		x
Christine and Christine (1964)	x	

Because previous research has not been unanimous in its findings regarding the correlation between chronological age and auditory discrimination ability, the ages of the children in the test sample of this study were noted and later correlated with their auditory discrimination scores.

SUMMARY OF THE CHAPTER

An attempt has been made in this chapter to relate findings of various studies indicative of the type of recent research relating to auditory discrimination ability of children.

Studies in this area have shown:

(1) Poor readers tend to be weak in auditory discrimination ability.

(2) Children from lower socio-economic status areas tend to have more difficulty with discrimination of speech sounds than children from the higher socio-economic status levels.

(3) Differences in auditory discrimination ability due to sex have not been proved conclusively.

(4) Auditory discrimination ability and intelligence are positively related.

(5) Auditory discrimination ability and chronological age may be positively related.

As a result of the findings cited in this chapter it was decided to:

(1) Select a test sample from a population of kindergarten children;

(2) Select a test sample which would contain children of the high, middle, and low socio-economic groups;

(3) Select a test sample consisting of thirty boys

and thirty girls;

(4) Administer an intelligence measure to the test sample and correlate the results with the results of the auditory discrimination test, and;

(5) Note the chronological age of the children in the test sample and correlate that data with the results of the auditory discrimination test.

At this point it must be noted that variations in the research findings quoted in this chapter may be a result of many factors. Differences in design, sampling, measuring instruments, and dialects would certainly account for the variety in findings of the research cited.

CHAPTER III

THE DESIGN OF THE STUDY

This chapter is a description of the design of the study. The following areas will be discussed:

(1) Sampling;

(2) Test instruments:

  (a) auditory discrimination test instrument,

  (b) other test instruments;

(3) Pilot study; and

(4) Data analysis.

SELECTION OF THE TEST SAMPLE

The overall population, from which the test population was selected, consisted of all children attending private and public kindergartens just prior to beginning grade one the following term in the city of Edmonton, Alberta. The test population consisted of 142 children attending four kindergartens which represented high, middle, and low socio-economic areas as designated by school officials. The test sample consisted of ten boys and ten girls who were randomly selected to represent each socio-economic status area, thus producing a total sample of sixty children. Table V shows the distribution of the children in the sample with regard to sex and socio-economic status.

TABLE V

DISTRIBUTION OF TEST SAMPLE BY SES AND SEX

SES Group	Kindergartens	Boys	Girls	Total Sample
High	1*	10	10	20
Middle	1*	10	10	20
Low	1**	5	5	10
	1**	5	5	10
Total	4	30	30	60

* privately owned kindergarten
** public school kindergarten

Because this study was attempting to investigate the ability of children to auditorially discriminate between vowel and semivowel speech sounds, the children in the private kindergartens were tested for auditory acuity with a Zenith portable audiometer. Children from the public school kindergartens were given a comparable audiometric test by the health department and the results were made available to the investigator by the teachers of those classes. As a result of the auditory acuity examinations, four subjects were eliminated from the study and were replaced by four other randomly selected children from the same classes. In three of the four cases where inadequate auditory acuity had forced a child to be removed and replaced in the study it was the health department audiometric testing which picked out those with inadequate

hearing. The number of children replaced in this study were found to represent about 7 per cent of the test sample. Oberg (1970:55-56) found that approximately 13 per cent of the children in her test sample had to be removed and replaced due to inadequate auditory acuity.

The fact that children with hearing deficiencies are being located during the audiometric testing program by the public schools indicates that this is a very worthwhile project. This early assessment is extremely important in that it serves to indicate the child's level of auditory acuity. Such information is useful for teachers to have when planning developmental and remedial activites in oral and written language.

Socio-Economic Status of the Sample

Language ability plays a basic part in reading achievement in general (Strang, McCullough, and Traxler, 1967:28-31) and auditory discrimination ability in particular (Edwards, 1965:547).

Because an acceptable standardized test of language ability for young children does not appear to be available at this time, researchers (Fast, 1968; Cosens, 1968; Oberg, 1970) have attempted to look at language ability through knowledge of socio-economic status. This was done on the assumption that in homes where the parents had a higher education and income level more money was spent on books and more time was devoted to reading and discussing matters

of interest with the children in the family. Examination of research has led to the conclusion that an examination of language ability through the use of socio-economic status scales would not be adequate for this study. Although more books and magazines are found in wealthier homes, these materials are not always read and may be for display only. Furthermore, it may be that parents do not sit down and read and talk to their children in the upper socio-economic families any more than this is done by the families in the lower socio-economic groups.

At present there are many high paying jobs which do not necessarily require a high level of formal education. In addition the present credit systems employed by merchants allows anyone to purchase goods formerly far beyond their reach. Now items such as books and television are common in most homes whether they are in higher or lower socio-economic areas. Given this situation scales such as those developed by Blishen (1968), and Elley-Gough (1961) may not be particularly valid indicators of language ability. Although Oberg (1970) sought to investigate socio-economic status of her subjects and their parents by using a modified version of the Elley-Gough (1961) scale she concluded, "In view of the reaction that many of the questions were of an extremely private nature and had no bearing on the proposed study, the investigator would have strong reservations about using this type of instrument in a future study" (p. 49).

Because of the questionable validity of socio-economic status scales when they are used in place of language ability tests for the purpose of predicting success in reading skill areas it was decided to select, in consultation with school officials, a number of kindergartens from different socio-economic areas. It was to be hoped that the test sample drawn from these kindergartens would contain some children from each of the socio-economic groups. While the intention was not to say that any particular child was from any one socio-economic group an attempt was made to include, by wide test sample selection, children from different socio-economic backgrounds. In this way if a difference in language ability does exist among those of varying socio-economic status, that element is distributed fairly evenly within the test sample.

Chronological and Mental Ages of the Test Sample

The mean chronological age of the thirty boys in the test sample was 69.30 months. The mean chronological age of the girls, 69.03 months, was almost identical to that of the boys. The mean mental age of the boys and of the girls was 80.77 months.

Table VI provides a summary of the means of chronological age and mental age as scored by boys, girls, and the sample as a whole.

TABLE VI

MEAN CHRONOLOGICAL AND MENTAL AGES, IN MONTHS, OF TEST SAMPLE BY SEX

Sex	Chron. Age	Ment. Age (Lang.)	Ment. Age (Non-Lang.)	Ment. Age (Total)
Boys (N=30)	69.30	78.20	81.83	80.77
Girls (N=30)	69.03	78.57	81.33	80.77
Total (N=60)	69.17	78.38	81.58	80.77

TEST INSTRUMENTS

During this study the sixty children in the test sample were examined by several test instruments. All children were given an audiometric screening test, a test of intelligence, and an auditory discrimination measure. A discussion of the tests given to the children will be carried out in this section. The first part of this section will be devoted to information regarding the construction of the auditory discrimination test. The second part of the section will include a discussion of the audiometric test, and the intelligence test.

The Vowel and Semivowel Auditory Discrimination Test

According to Gleason (1961) there are three significant variables in a phonetic description of the production of English vowels: tongue position, tongue height, and

rounding of the lips (1961:35). Using what he considers to be the primary variables, tongue height and tongue position, Gleason charts the English vowels in this way (1961:35):

TABLE VII

TONGUE MOVEMENT IN VOWEL SPEECH SOUND PRODUCTION

Tongue Height	Tongue Position		
	Front	Central	Back
High	i ⟨bit⟩	ɨ	u ⟨put⟩
Mid	e ⟨bet⟩	ə ⟨but⟩	o
Low	æ ⟨bat⟩	a ⟨bought⟩	ɔ ⟨ball⟩

Because of the infrequent use of the pure /ɨ/, and /o/ speech sounds in the North American English dialect (Gleason, 1961:31-33) it was decided to eliminate these speech sounds from the present study. In addition to the pure vowels examined in this study, an effort was made to study comparisons among complex syllable nuclei, that is, a vowel and a following semivowel. Comparisons among these sounds were also included in the test:

(1) /iy/ as in ⟨beat⟩

(2) /ey/ as in ⟨bait⟩

(3) /ay/ as in ⟨bite⟩

(4) /ow/ as in ⟨boat⟩

(5) /uw/ as in ⟨boot⟩

(6) /aw/ as in ⟨bout⟩

In the production of these sounds, the tongue begins in the position for the production of a pure vowel speech sound, and moves to a position for the production of the following semivowel speech sound.

Criteria for the selection of consonant speech sounds which surround the syllable nuclei speech sounds were:

(1) Articulation studies by Templin, Wellman, and Poole, as reported by Templin (1957) have indicated the ages at which children can successfully articulate various speech sounds. In the pilot study care was taken to exclude consonant sounds which, according to Templin (1957), were not correctly articulated by at least 75 per cent of the children in the study by age six. These sounds were /z/ as in zip, /$\overset{v}{z}$/ as in azure, and /$\overset{v}{j}$/ as in Jill. Because Olmstead (1963:531) had suggested that sounds which children can articulate are the sounds which they correctly perceive, the speech sounds/z/, /$\overset{v}{z}$/, and /$\overset{v}{j}$/ were eliminated in an attempt to avoid placing the children in a position where confusion in the auditory discrimination of these consonant speech soundscould contaminate the data.

(2) A study by Dewy (1923) noted the relative frequencies of occurrence of various speech sounds in English. According to Dewy (1923) the most frequently used consonant speech sounds are /l, r, n, s, d, t/. Special

consideration was given to selecting word-pairs in which these consonant speech sounds surrounded the syllable nuclei.

(3) Two word controls were exercised in the construction of the test: Pronunciation screening was attempted by using the Gage Dictionary of Canadian English as a gross determiner of whether or not the simple syllable nuclei speech sound contrasts were actually minimal word-pairs. Because there are a large number of dialect differences within Canada, a second screen on pronunciation was employed. The individual who recorded the auditory discrimination test on tape, a female native to Edmonton, Alberta, ruled on cases where the dictionary analysis appeared to be at odds with the pronunciation as it appeared in her western Canadian speech.

Word frequency control was established as often as possible by selecting words, to form the word-pairs, which were equally familiar to kindergarten children. A combined study by Buckingham (1936) listed the findings of a number of different studies which examined the frequency of English words in oral language usage. Two of these studies concentrated on the word usage of kindergarten children. As often as possible the word-pairs in The Vowel and Semivowel Auditory Discrimination Test were composed of words found to be of equally frequent occurrence in the oral language usage of kindergarten

children.

The pilot study auditory discrimination test consisted of 385 items. This test was administered to a random sample of nine kindergarten children. The details of the pilot study are in the next section of this chapter.

No computer program was available at the University of Alberta at that time to do an item analysis on the large number of items on the pilot test results so error scores on specific test items were compiled by hand using a procedure which differentiated the errors made by the bottom three, middle three, and top three scorers on this test. The results of this error tabulation allowed an examination of the errors made by each of the groups of scorers.

In addition to the criteria originally used for the selection of items for the pilot study test, additional criteria were used in selecting items for the final instrument:

(1) The results of the initial test produced an estimate of the relative difficulty of the original test items. The word-pairs which had from seven to nine errors were considered to be the most difficult items. Word-pairs on which four to six errors were made were considered to be of moderate difficulty. The least difficult items were those on which less than four errors were made. There were many items on which no errors were made by any of the

children in the pilot test sample. Within the confines of having fairly equal proportions of items testing different sound contrasts represented on the final test a representative selection of items of varying difficulty was included on the final instrument.

(2) An investigation of Oberg's research (1970) employing the Fast-Cosens Auditory Discrimination Test with kindergarten children indicated which consonant speech sounds children in kindergarten in her study had the most difficulty auditorially discriminating. According to Oberg (1970:96) the most difficult items were those which tested fricatives, stops, and nasals. (See Table VIII).

In order to note the possible effects of phonological environment, thirty-five word-pair items were constructed with the lateral /l/ and glides /r/, /w/, /y/ surrounding the syllable nuclei. As these speech sounds were not considered difficult for kindergarten children to auditorially discriminate, the word-pairs in which syllable nuclei were teamed with /l/, /r/, /w/, or /y/ were termed "easy" word-pairs. In eighty instances the syllable nuclei were teamed with stops such as /p, t, k, b, d, g/, fricatives such as /f, v, θ, ð, s, š, h/, and nasals such as /n, m, ŋ/. In these cases, because the syllable nuclei were teamed with consonant speech sounds which kindergarten children had found difficult to discriminate, the items were termed "hard" word-pairs.

TABLE VIII

MOST DIFFICULT* TEST ITEMS AS MEASURED BY THE FAST-COSENS AUDITORY DISCRIMINATION TEST AT END OF KINDERGARTEN

Word-Pair	Type of Sound	Position	Voicing**	Difficulty Index
fence-thence	Fricative-Fricative	Initial	vl	.125
bad-bag	Stop-Stop	Final	vd	.350
lathe-lave	Fricative-Fricative	Final	vd	.400
clove-clothe	Fricative-Fricative	Final	vd	.450
winning-winging	Nasal-Nasal	Medial	vd	.475
rung-rum	Nasal-Nasal	Final	vd	.475
thy-vie	Fricative-Fricative	Initial	vd	.525
vow-thou	Fricative-Fricative	Initial	vd	.550
lease-leash	Fricative-Fricative	Final	vl	.550
coke-cope	Stop-Stop	Final	vl	.575
fought-thought	Fricative-Fricative	Initial	vd	.600
cap-cat	Stop-Stop	Final	vl	.600
cog-cob	Stop-Stop	Final	vd	.625
peak-peep	Stop-Stop	Final	vl	.625
sheep-sheath	Stop-Fricative	Final	vl	.625
sun-sung	Nasal-Nasal	Final	vd	.625
rub-rug	Stop-Stop	Final	vd	.650
bail-vale	Stop-Fricative	Initial	vd	.675

* Those test items on which less than 70 per cent of the subjects gave a correct response.
** vl - voiceless vd - voiced

As was done by Wepman on the Wepman Auditory Discrimination Test, the proportion of unlike to like word-pairs on The Vowel and Semivowel Auditory Discrimination Test was approximately two to one. Because The Vowel and Semivowel Auditory Discrimination Test contained seventy-seven unlike and thirty-eight like word-pairs, a similar proportion of approximately two unlike to one like word-pair was used as often as possible to test the various speech sound contrasts. The like word-pair items served as a validity check on the final test, in that the subjects should be able to correctly determine which are the like word-pairs if they can correctly answer the unlike word-pair items. Presumably a child should be well acquainted with a speech sound if he can distinguish it from other speech sounds. By maintaining a similar proportion of like and unlike word-pairs in the testing of the various speech sound contrasts, as well as for the test as a whole, it was hoped to minimize correct responses due to repetition rather than auditory discrimination ability.

The various simple and complex syllable nuclei speech sounds were compared in the initial, medial and final positions as often as possible. Table IX will serve to illustrate how the speech sounds were compared.

As Table IX indicates, most speech contrasts were made separately between simple syllable muclei, and between complex syllable nuclei. The vast differences in speech

TABLE IX

SIMPLE AND COMPLEX SYLLABLE NUCLEI COMPARED IN THE FINAL EDITION OF THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

	i	e	æ	ə	a	u	ɔ	iy	ey	ay	oy	ow	aw	uw
i	>V	V	V	V		V	>V	V				>		V
e	V	>V	>V		V	V	V					>		
æ	V	>V	V	V	>V	V								
ə	V		V	V	V		V							
a		V	>V	V	V	V						V		<
u	V	V	V		V	V	V							
ɔ	>V	V		V		V	V							
iy	V							>V<V<V<V	>V<V<V<V	>V<V	>			V
ey									>V<V<V<V	>V<V	>			V
ay										>V<V				
oy														
ow	>	>			V							>V	V	V<
aw												V	>V<	V<
uw	V				<			V	V			V<	V<	<

> - comparison in initial position
< - comparison in final position
V - comparison in medial position

sounds between simple syllable nuclei and complex syllable nuclei did not make contrasts between these groups worth while in most cases.

As a result of observations during the pilot study, and discussions with kindergarten teachers it was learned that approximately fifteen minutes is the maximum length of time these children can function effectively at any one task. Factors such as fatigue and short concentration span of the children prompted the investigator to shorten the final test to 115 items. The final version of The Vowel and Semivowel Auditory Discrimination Test took approximately fifteen minutes to administer whereas the pilot study test required about one hour including a number of rest periods designed to minimize fatigue.

Summary

Auditory discrimination ability was measured by a 115 item word-pair test instrument constructed by the investigator. The Vowel and Semivowel Auditory Discrimination Test was administered to all subjects by the investigator and an assistant during the month of May, 1970. The test was recorded on tape, under quiet but not soundproofed conditions, in order to ensure consistency of presentation during the many administrations. The female voice on the tape was that of a native Edmontonian. Due to factors such as fatigue and short attention span of the children, the tape was stopped for a short break at the end of each

thirty-five items.

Directions for the test were similar to those used by Oberg (1970) for the administration of the Fast-Cosens test. The sample items consisted of word-pairs which differed in only one syllable nuclei speech sound. A copy of the complete test including directions will be found in Appendix A.

Of the 115 test items in the final version of the instrument, there were twenty-one items comparing speech sounds in the initial position, seventy-six items comparing speech sounds in the medial position, and eighteen items comparing speech sounds in the final position. Because of the frequency with which syllable nuclei appear in the medial position in words, more items were devoted to testing this position than testing the initial or final positions.

There were seventy-seven unlike and thirty-eight like word-pairs on the test. Simple syllable nuclei were compared sixty-six times while complex syllable nuclei were compared forty-nine times. Of the 115 items on the instrument, thirty-five items were classified as "easy" word-pairs because the syllable nuclei were matched with consonant sounds which can be auditorially discriminated by most kindergarten children. Eighty items are classified as "hard" word-pairs because the same syllable nuclei are matched with consonant speech sounds which kindergarten children have found difficult to auditorially discriminate

(Oberg, 1970:106). Table X shows the breakdown of item types found on The Vowel and Semivowel Auditory Discrimination Test.

TABLE X

ITEM TYPES ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

N=115		N=115			N=115		N=115	
Like	Unlike	Initial	Medial	Final	Hard	Easy	Simple Nuclei	Complex Nuclei
38	77	21	76	18	80	35	66	49

Validity. Construct validity was sought by basing the choice of items on articulation errors (Templin, 1957), discrimination errors (Oberg, 1970), frequency of usage of consonant speech sounds (Dewy, 1923), and frequency of usage of vowel and semivowel speech sounds (Gleason, 1961).

Content validity was sought by choosing test items from words which are equally familiar to kindergarten children. Most of the words were at a kindergarten level of usage according to the Horn, and Kindergarten Union word lists as found in Buckingham (1936).

Reliability. Using a group of sixty randomly selected kindergarten children in the test sample the 115 item test had a KR-20 reliability index of .82.

Other Test Instruments

The following tests were administered to each of the sixty kindergarten children who composed the final test sample.

(1) Each of the sixty subjects was given an individual audiometric screening test by the researcher and an assistant; or by a trained public health nurse during March and April of 1970. In cases where the subject's responses to the audiometer were inconsistent, the instrument was checked in order to determine the possibility of a breakdown. If the machine was proven operative at all frequency and decibel levels the child was retested.

A Zenith audiometer is designed to test the subject's hearing in the 250 to 8000 cycles per second range which includes the range of speech sounds. Hearing loss is registered in decibels. At the level of zero decibels hearing loss, the audiometer produces a tone having an intensity required to reach the threshold of the average ear 50 per cent of the time. The intensity is controlled in five decibel steps and the hearing loss is expressed in terms of the number of decibels which exceed the zero point (Newby, 1964:65). For the purposes of this study any subject with a hearing loss greater than twenty-five decibels over two or more frequency levels was removed from the study and replaced with another randomly selected subject.

During testing, the subject was seated with his back

to the audiometer. Directions and practise attempts were made to ensure that each subject understood the directions and procedures thoroughly. During the testing, care was taken to vary the intervals between the tones in order to lessen the possibility that the child was responding to a rhythm pattern rather than what he actually heard. Hearing was tested in each ear separately. The children were tested in a room beside the main play area for the rest of the kindergarten. The rooms were not soundproofed, however they did provide an area in which the child would not be distracted by other children playing around him. All of the four children who were eliminated due to inadequate auditory acuity suffered a loss of hearing in the higher frequencies.

(2) The choice of the California Short-Form Test of Mental Maturity was based partly on the success of previous investigators (Cosens, 1968; Oberg, 1970) with this intelligence test. In addition, Stanely, writing in Buros (1965:696), has suggested that this instrument is most useful at kindergarten through about the third grade.

The California Short-Form Test of Mental Maturity (Level O) measures intelligence in terms of four factors: logical reasoning, numerical reasoning, verbal concepts, and memory. The test consists of Language, and Non-language task sections for which a separate mental age and intelligence quotient can be derived. In addition, this instrument

provides a combined Language, and Non-language intelligence quotient and mental age.

THE PILOT STUDY

Test Sample

A pilot study in which a test of 385 word-pair items was administered to nine kindergarten children was carried out during the first week of May, 1970. Data regarding these children is given in Table XI.

TABLE XI

ANALYSIS OF CHILDREN IN PILOT STUDY SAMPLE BY SES AND SEX

Children	Socio-Economic Status			
	High	Middle	Low	Total
Boys	2	2	2	6
Girls	1	1	1	3
Total	3	3	3	9

Of the nine children randomly selected for the test sample, two boys and one girl were from each of a low, middle, and high socio-economic status area as designated by school officials. The total pilot study sample consisted of six boys and three girls.

Test Item Types

The following table illustrates the number of test

item types used in the initial test draft in the pilot study.

TABLE XII

BREAKDOWN OF ITEM TYPES WHICH APPEARED ON THE INITIAL TEST

Word-Pair Type		Speech Sound Position in Word-Pairs		
Like	Unlike	Initial	Medial	Final
104	281	29	323	33

The first step in the construction of the initial test draft was a decision regarding what speech sound contrasts should be tested. The preceding section based on the development of the auditory discrimination test discussed the criteria. Once a list of speech sounds to be tested was made, the investigator sought to use every possible word, and word-pair, designated as being familiar to the oral language of kindergarten children by the Buckingham (1936) study. The results of this effort produced twenty-nine word-pairs in which the speech sounds to be discriminated were in the initial position, 323 word-pairs with speech sounds in the medial position, and thirty-three word-pairs in which the speech sounds were in the final position. The justification for the relative proportion of items in each of these positions was the frequency with which they appeared in a list of words

frequently found in the oral language of kindergarten children.

As there were 385 test items on the initial draft of the test, the investigator attempted to construct items in the proportion of one like word-pair to three unlike word pairs. The result of this procedure was a total of 104 like word-pairs, and 281 unlike word-pairs in the initial test. Because the test items had been randomly assigned a place on the test, a random selection of 104 unlike word-pairs was made and altered to become like word-pairs. Like word-pair items were included for two reasons:

(1) To lessen the child's chances of scoring correct answers by continually giving the same response to test items; and

(2) To serve as a check for validity of the test. If a child can determine which sounds are alike, he should be able to tell if a particular sound differs from another sound when they are contrasted.

Results of the Pilot Study

The pilot study was administered to nine kindergarten children who represented the high, middle, and low socio-economic status areas. There were six boys, and three girls in the pilot study sample. Table XIII indicates the mean scores of children from each socio-economic status level, as well as for the boys and girls.

TABLE XIII

MEAN TEST SCORES ON THE PILOT INSTRUMENT BY CHILDREN IN THE TEST SAMPLE WITH CONSIDERATION TO SEX AND SOCIO-ECONOMIC STATUS

Children in the Sample	High (N=3)	Middle (N=3)	Low (N=3)	Total (N=9)
Boys (N=6)	368.5	317.0	334.5	340.0
Girls (N=3)	363.0	363.0	254.0	323.3
Total (N=9)	366.7	332.3	307.7	335.6

*Total possible test score = 385.

The results of the pilot test indicated that the high socio-economic status student group did better than the middle socio-economic status group who in turn did better than the low socio-economic status group. The boys in the sample did better than the girls on the pilot test. It was noted during the testing session that the middle socio-economic status boys seemed quite restless. Their inattention may have resulted in lower scores on the test than their low socio-economic status peers. The girl from the low socio-economic status sample was from a family of German background. Although she appeared to be aware of the concepts "like" and "unlike" she scored very low on the test. As another language was spoken in her home she may have been somewhat confused by the sounds contrasted on the

pilot study test.

The following table illustrates the range of scores achieved on the pilot instrument.

TABLE XIV

THE RANGE OF SCORES OBTAINED ON THE PILOT STUDY TEST

Ability Groups	Score	Frequency
High	254 - 324	3
Middle	325 - 360	3
Low	361 - 373	3

As can be seen from Table XIV the range of scores on the pilot test was from 254 to 373 out of a possible 385 items. Using a system where each of the three groups was given an individual color code, error scores on the pilot test were compiled. The use of this procedure allowed the investigator the opportunity to determine which items created difficulty for all of the ability groups, as well as which items were particularly hard for any one ability group.

Table XV indicates the error scores of a number of word-pairs found on the pilot study test instrument. Although it would be quite cumbersome to indicate this data for all 385 items on the test, a sample of the classifications

TABLE XV

EXAMPLES OF MOST DIFFICULT AND LEAST DIFFICULT TEST ITEMS FOR STUDENTS OF THE PILOT STUDY

Difficulty	Word Pair	Error Score	Prime Difficulty for:			
			All Groups	Low Group	Mid Group	High Group
Most Difficult (7-9 errors)	except-accept	9	x			
	affect-effect	9	x			
	e di tion-addition	7	x			
	elude-allude	7	x			
	chair-cheer	8	x			
Moderately Difficult (4-6 error)	hall-hull	5		x	x	
	truck-track	5		x	x	
	nick-neck	5		x	x	
	hall-hill	6		x	x	
	coughing-cuffing	5		x	x	
Least Difficult (0-3 errors)	wyle-wail	2		x		
	east-iced	2		x		
	rook-rock	2		x		
	sly-sleigh	1		x		
	oat-oat	1		x		
	tea-tie	1		x		
	ill-all	1		x		
	elder-older	0				
	black-block	0				
	eat-eat	0				

will serve to indicate how the word-pairs were classified. Table XV shows how many error scores were recorded in a number of difficulty classifications. Items from each of these classifications were selected for use on the final test instrument.

An examination of Table XVI will show the number of items which fell into each of the difficulty categories as previously defined.

TABLE XVI

THE NUMBER OF ITEMS CLASSIFIED AS BEING MOST DIFFICULT, MODERATELY DIFFICULT, AND LEAST DIFFICULT FOR THE CHILDREN IN THE PILOT STUDY SAMPLE

Number of Items	Most Difficult (7-9 errors)	Moderately Difficult (4-6 errors)	Least Difficult (0-3 errors)
N = 385	5	5	375

Although items with up to three errors were classified as being least difficult, for the purposes of the pilot study, any item with three errors is an item which was missed by one third of the children in the pilot study test sample. The large number of least difficult items was a result of the large number of items on which none of the pilot study test sample children made an error. With only nine children working on a 385 item test, it seems reasonable to expect a large number of test items on which

none of the children erred.

The following table shows the breakdown of item types on the pilot study test in terms of difficulty for the children in the pilot study test sample.

TABLE XVII

CLASSIFICATION OF PILOT STUDY TEST ITEM TYPES ACCORDING TO DIFFICULTY

Difficulty of Items	Like and Unlike Word-Pairs		Position of Sound in Word-Pair			Simple Syllable Nuclei	Complex Syllable Nuclei
	Like	Unlike	I.	M.	F.		
Most Difficult (7-9 errors)	0	5	4	1	0	5	0
Moderately Difficult (4-6 errors)	0	5	0	5	0	5	0
Least Difficult (0-3 errors)	104	271	25	317	33	250	125

As indicated by Table XVII, the like word-pairs did not appear to create any difficulty for the children in the pilot study test sample whereas ten unlike word-pairs were found to be in the moderately and most difficult classes.

Among the moderately and most difficult items on the pilot study test were word-pairs in which the syllable nuclei were in initial and medial positions. It was

interesting to note that no word-pairs in which syllable nuclei were situated in the final position were included in the moderate and most difficult classes. There were no complex syllable nuclei found in the moderate and most difficult classes, although in ten instances simple syllable nuclei were found to be moderately or most difficult for purposes of the pilot study.

ANALYSIS OF THE DATA

Organization of the Data

The California Short-Form Test of Mental Maturity (Level O) for each subject was hand scored by the investigator and an assistant. Responses to the auditory discrimination test were recorded on IBM answer sheets and later scored by the IBM Optical Scorer in the computer department, University of Alberta, Edmonton.

Intelligence and auditory discrimination test data, as well as information regarding the subjects' chronological age and sex, were punched on data cards by the TEST 06 program as set up by computer services at the University of Alberta.

Item Analysis

An item analysis, using the TEST 04 program on the 115 items of the auditory discrimination test, was made in order to observe pupil performance within the group as well as to determine the order of difficulty of the test items.

The K-R 20 reliability index for the test was .82 indicating that the test was adequately reliable.

Correlation Coefficients

Considering the entire test sample, correlations were determined between total test scores on the auditory discrimination test, and the following variables:

(1) chronological age, and

(2) mental age.

Using the Dest 02 computer program, these correlation coefficients tested hypothesis two.

Analysis of Variance

In order to test for significant differences in pupil performance on the auditory discrimination test, an analysis of variance, using the Anov. 10 computer program was carried out on total pupil scores and the following:

(1) scores for each of the tongue position contrasts;

(2) scores for each of the speech sound contrasts;

(3) scores for sounds in the initial, medial, and final positions;

(4) scores for like, and unlike word-pairs;

(5) scores for easy, and hard word-pairs; and

(6) sex of the particular subject.

This analysis of variance tested hypotheses one and three.

CHAPTER IV

FINDINGS OF THE STUDY

This chapter will present the results of the data analysis based on information gathered from the children in the test sample, and their performance on The Vowel and Semivowel Auditory Discrimination Test. Student performance will be analyzed and discussed in section one. Correlations showing the relationship between mental age and auditory discrimination, and chronological age and auditory discrimination will be discussed in section two. Prior to a summary of the chapter, section three will include a discussion of the analysis of variance on total test scores and nineteen subscores obtained from the administration of the auditory discrimination measure.

A DESCRIPTIVE ANALYSIS OF PUPIL PERFORMANCE

The purpose of this section will be to discuss and analyze pupil performance on The Vowel and Semivowel Auditory Discrimination Test.

Pupil Achievement on the Total Test

The total possible score on The Vowel and Semivowel Auditory Discrimination Test was 115. Table XVIII presents the test mean, the test variance, and the standard deviation for both the total test sample and the five achievement groups of the sample on the auditory

TABLE XVIII

PERFORMANCE OF PUPILS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Pupil Level	No. of Pupils	Test Mean	Test Variance	Standard Deviation	Achievement Group Name	No. in Group	Range of Scores 115/115	Range in Marks
Kindergarten	60	99.80	44.66	6.683	Group 5	11	106-111	5
					Group 4	14	102-105	3
					Group 3	8	101-101	-
					Group 2	14	96-100	4
					Group 1	13	83- 95	12

discrimination test. Each of the five groups represents approximately 20 per cent of the total pupil scores ranging from the bottom 20 per cent to the top 20 per cent in achievement on the test. For the purposes of this study, group one children will be termed low ability, and group five children will be termed high ability, when referring to achievement in auditory discrimination.

An examination of the mean score for the auditory discrimination test indicates that these subjects were able to correctly discriminate approximately 87 per cent of the items. Although the pupils of the test sample as a whole did not experience difficulty with a large number of items if the speech sounds which were not accurately discriminated tend to occur frequently in language usage, then difficulties with both oral and written language may result.

The fact that the kindergarten children in this study achieved a mean score of approximately 87 per cent on a syllable nuclei focused auditory discrimination test, as compared to a mean score of 84 per cent on a consonant based auditory discrimination test by Oberg's sample of children (1970:71), may indicate that kindergarten childrens' ability to auditorially discriminate syllable nuclei speech sounds is no better than their ability to auditorially discriminate consonant speech sounds. The fact that most children can articulate all vowel speech sounds by age six (Templin, 1957) has led theorists

(Olmstead, 1966) to suggest that children this age should be capable of correctly discriminating these sounds auditorially.

As Figure 1 and Table XIX show, the scores on The Vowel and Semivowel Auditory Discrimination Test ranged from a low score of eighty-three to a high score of 111 out of a possible total of 115 items. The mean score was 99.80. Most of the children scored in the range between ninety-four and 104, with the most frequently attained scores being 100 and 101.

It must be noted that although none of the children in the test sample were below a score of eighty-three, none of the children answered all the test items correctly. This would seem to indicate that some instruction in auditory discrimination of syllable nuclei speech sounds might be beneficial to all of the children in the test sample.

Position of Sound in Word

Table XX indicates the mean performance on the unlike word-pairs in which the syllable nuclei speech sounds are in the initial, medial, or final position in words. According to Table XX, on an average, the children correctly answered approximately 80 per cent of the test items which focused on speech sounds in the initial position, 81 per cent of items which focused on speech sounds in the medial position, and 94 per cent of items

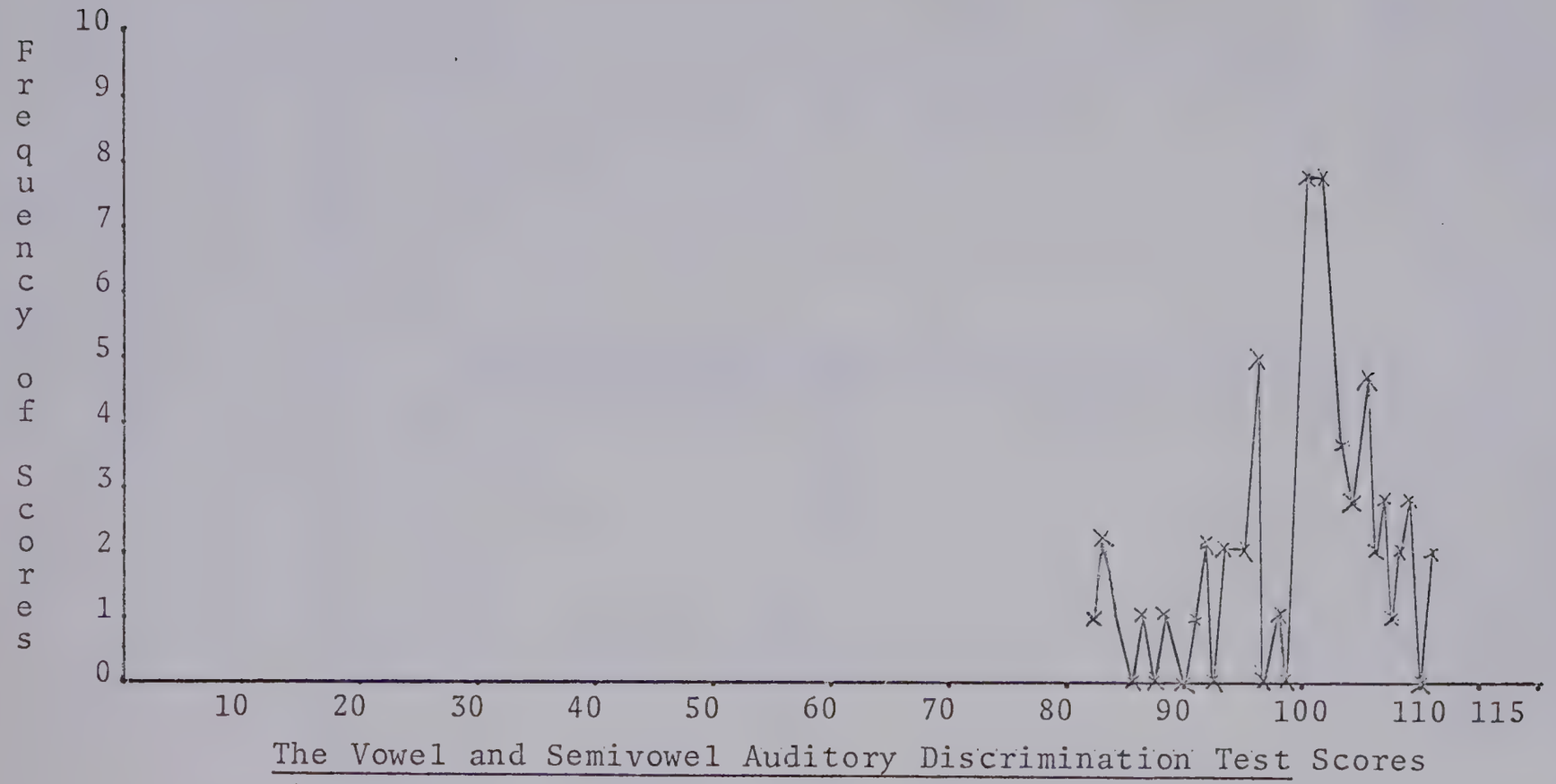

FIGURE 1

DISTRIBUTION OF SCORES ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

TABLE XIX

DISTRIBUTION OF CHILDRENS' SCORES ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Progression of Scores	Total Range of Scores	Frequency of Scores	Achievement Groups
Lowest Score	83	1	
	84	2	
	85	1	
	86	0	Group 1
	87	1	N=13
	88	0	
	89	1	
	90	0	
	91	1	
	92	2	
	93	0	
	94	2	
	95	2	
	96	5	
	97	0	Group 2
	98	1	N=14
	99 Group	0	
	100 Mean	8	
	101	8	Group 3 N=8
	102	4	
	103	3	Group 4
	104	5	N=14
	105	2	
	106	3	
	107	1	
	108	2	Group 5
	109	3	N=11
	110	0	
Highest Score	111	2	
Total		60	

TABLE XX

MEAN PERFORMANCE OF PUPILS ON POSITION OF SOUNDS IN WORDS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Position of Sound in Word Contrasted	No. of Test Items	Mean Performance of Pupils on Position of Sounds in Words on The Vowel and Semivowel Auditory Discrimination Test	
		Mean	Achievement in % on Each Position
Initial	21	17.05	80.12
Medial	76	65.85	80.66
Final	18	16.90	93.89
Total Test Items	115		

which focused on speech sounds in the final position. From these results it appears that the syllable nuclei speech sounds in the final position were more easily auditorially discriminated than speech sounds in the initial and medial positions.

While Oberg's (1970) consonant focused study found that sounds in the final position were most difficult to discriminate for her kindergarten sample, the children in this present study found that syllable nuclei speech sounds in the final position were the easiest to discriminate. Table XXI compares the findings on the relative difficulty of positions of speech sounds for the kindergarten children in Oberg's (1970) study, and the kindergarten

children in the present study.

TABLE XXI

COMPARISON OF MEAN PERFORMANCE BY KINDERGARTEN CHILDREN IN THE OBERG (1970), AND MOFFATT STUDIES

Position	Consonant Speech Sounds (N=266) Oberg (1970)	Vowel and Semivowel Speech Sounds (N=115) Moffatt
Initial	31.80/39 = 82%	17.05/21 = 80%
Medial	27.85/33 = 84%	65.85/76 = 81%
Final	47.88/61 = 78%	16.90/18 = 94%

Dinneen (1967:30) has stated that differences in "length" are noticeable in all of the vowels depending on the kind of consonants that follow them in the same syllable, or whether or not the vowel is followed by consonants in the same syllable. If the "length" of the syllable nuclei speech sounds are not restricted by a following consonant in cases where the vowels and semivowels are in the final position in words, then perhaps this added "length" might allow an individual more time to listen to the power of the vowel or semivowel, thus increasing his chances of correctly differentiating among speech sounds which may be quite similar.

"Easy" and "Hard" Word-Pairs

Klumpp (1964:3) has found that consonant perception

is dependent, in part, on momentary perturbations in adjacent speech sounds. He found that the significant acoustical characteristics of some consonants could not be specified adequately without taking into account the changes induced in adjacent vowel formants.

A further case for the significance of phonological environment was found in the relative success the children in the sample had with the "easy", as opposed to the "hard", word-pairs. Table XXII shows that the mean performance of the children in the sample on the "easy" word-pairs was 94 per cent. The mean performance, by the same children on the "hard" word-pairs was 85 percent.

TABLE XXII

MEAN PUPIL PERFORMANCE ON THE "HARD" AND "EASY" WORD-PAIRS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Type of Word Pair	No. of Test Items	Mean	Correct Responses by Total Group in %
Easy	35	32.033	94.30
Hard	80	67.767	84.79

It appears therefore that auditory discrimination of word-pairs may be more difficult in cases where syllable nuclei are surrounded by consonants which kindergarten children find difficult to auditorially discriminate. It may be that difficulty in auditory discrimination is primarily a

result of difficulty with syllable nuclei speech sounds, primarily a result of difficulty with consonant speech sounds, or primarily the result of difficulty with the sequence of syllable nuclei and consonant speech sounds operating together.

Like and Unlike Word-Pairs

The mean performance and standard deviations for the thirty-eight like, and seventy-seven unlike word-pairs for the sixty kindergarten children in the sample are presented in Table XXIII. For the test sample, the mean performance on the unlike word-pairs was 36.30 out of a possible thirty-eight items. The mean performance on the seventy-seven unlike word-pairs, was 63.50. An examination of mean pupil achievement in terms of percentages reveals that the childrens' performance on unlike word-pairs was approximately 82 per cent while on the like word-pairs, there was a mean of about 96 per cent. The difference in performance on the like, and unlike word-pairs indicates that the kindergarten children in this sample found discriminating differences a more difficult task than noting similarities. Oberg (1970:94) found that a similar situation existed with respect to like and unlike word-pairs on a consonant focused auditory discrimination test. Her sample of forty kindergarten children also found like word-pair items more easily discriminable than the unlike word-pair items. Table XXIV shows a comparison of

TABLE XXIII

PERFORMANCE OF KINDERGARTEN CHILDREN ON LIKE, AND UNLIKE WORD-PAIRS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Word-Pair Type	No. of Items	Means	Standard Deviation	Performance on Items by Kindergarten Children %
Like	38	36.30	1.84	95.53
Unlike	77	63.50	6.00	82.47
Total No. of Items	115			

the performance of the kindergarten children in Oberg's (1970) study with the performance of the children in the present study.

TABLE XXIV

COMPARISON OF KINDERGARTEN PUPIL PERFORMANCE ON LIKE AND UNLIKE WORD-PAIRS BETWEEN THE OBERG (1970) AND MOFFATT STUDIES

Word-Pair	Consonant Speech Sounds (N=266) Oberg (1970)	Vowel and Semivowel Speech Sounds (N=115) Moffatt
Like	116.38/133 = 88%	36.30/38 = 96%
Unlike	107.53/133 = 81%	63.50/77 = 83%

Fletcher (1953:86), on the bases of studies determining the phonetic and peak powers of individual speech sounds using a calibrated condenser transmitter, states that pure vowels are the most powerful speech sounds after which come the semivowels. Because of the increased power of the vowel and semivowel speech sounds as opposed to the weaker consonant sounds, it would seem reasonable to assume that the sound similarities in a like word-pair would stand out very clearly. The result, in this study, may have been that the children found like word-pair items less difficult than unlike word-pairs. Although the power of the vowel and semivowel speech sounds would come through strongly in unlike word-pairs also, the effect of the different syllable nuclei speech sounds working with the same following consonant speech sounds may produce combination speech sounds which are more difficult to discriminate.

Most Difficult and Least Difficult Items

Table XXV shows those thirteen word-pairs which less than 70 per cent of the kindergarten children, in this study, correctly auditorially discriminated.

Seven items involved the /e/ - /æ/ contrast, three items involved the /ə/ - /a/ contrast, one item involved the /u/ - /ɔ/ contrast, one item involved the /ɔ/ - /ə/ contrast, and one item involved the /u/ - /i/ contrast. Factors which may have contributed to difficulties are as

TABLE XXV

MOST DIFFICULT UNLIKE WORD-PAIR TEST ITEMS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Word Pair	Type of Contrast	Position	Difficulty Index
hall-hull	/ɔ/ - /ə/	medial	.150
elude-allude	/e/ - /æ/	initial	.150
wonder-wander	/ə/ - /a/	medial	.167
edition-addition	/e/ - /æ/	initial	.200
effect-affect	/e/ - /æ/	initial	.217
dance-dense	/æ/ - /e/	medial	.233
except-accept	/e/ - /æ/	initial	.250
catch-ketch	/æ/ - /e/	medial	.317
one-wan	/ə/ - /a/	medial	.417
coughing-cuffing	/a/ - /ə/	medial	.517
send-sand	/e/ - /æ/	medial	.650
bull-ball	/u/ - /a/	medial	.657
purse-pierce	/u/ - /i/	medial	.667

follows:

(1) Place of articulation. The /e/ and the /æ/ speech sounds are both articulated with the tongue in the front of the mouth. The /ə/ and the /a/ speech sounds are both produced with the tongue in the central area of the mouth. The /u/ and the /ɔ/ speech sounds are both produced with the tongue in the back of the mouth. Finally, the /i/ and the /u/ are produced with the tongue in a high position in the mouth. According to Langacker (1968:142-143) the position of the lips and tongue will emphasize the sounds at certain frequencies of pitch. The vowel sounds

articulated with the tongue in one position in the mouth will be of different "quality" than vowel sounds produced with the tongue in a different position. The more the "quality" of the vowel sounds are alike; the more difficulty an individual would have in discriminating among them auditorially. Perhaps the similar "quality" of the various sound contrasts represented in the most difficult test items has caused difficulty with these word-pairs.

(2) Stress. In several of the most difficult word-pairs the syllable nuclei to be auditorially discriminated were in an unaccented syllable of a multi-syllable word. While care was taken, during the taping of the test, to ensure that the /e/ and /æ/ speech sounds were not articulated as /ə/, the fact that these sounds were in an unemphasized portion of the word may have resulted in some confusion during discrimination for the children in the study.

(3) Phonological environment. In most cases the difficult word-pairs consisted of words in which the syllable nuclei speech sound was surrounded by consonants on both sides, or on one side in the case of the sounds in the initial position, by consonant speech sounds which kindergarten children have found difficult to auditorially discriminate.

According to Oberg (1970:96) the most difficult consonant speech sounds for kindergarten children to

auditorially discriminate are the stops, fricatives, and nasals. Refer to Table VIII for more detailed information on this topic. The consonant speech sounds which kindergarten children do not seem to find difficult to auditorially discriminate are the lateral /l/ sound and the glides /r, w, y/. It may be that the syllable nuclei speech sounds and the consonant speech sounds which surround them have worked separately or together as an influence on the auditory discriminability of word-pairs.

Table XXVI indicates the twenty-eight word-pairs which were correctly discriminated by 95 per cent or more of the children in the test sample.

According to Table XXVI, most of the least difficult test items were those in which the auditory discrimination of a complex syllable nucleus was required. When examined in terms of position of sounds in words, the least difficult items had occurred five times in the initial position, seventeen times in the medial position, and six times in the final position. In terms of percentages 25 per cent of the speech sounds in both the initial and medial positions were among the least difficult items, and 33 per cent of the items in the final position were among the least difficult items. The fact that a higher percentage of items in which speech sounds were tested in the final position, rather than the initial or medial positions, were included in the group of least difficult word-pairs

TABLE XXVI

LEAST DIFFICULT UNLIKE WORD-PAIR ITEMS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Word Pair	Type of Contrast	Position	Difficulty Index
boat-boot	/ow/ - /uw/	medial	.950
hurt-heart	/u/ - /a/	medial	.950
clue-claw	/uw/ - /a/	final	.950
fly-flea	/ay/ - /iy/	final	.950
bout-boot	/aw/ - /uw/	medial	.950
kit-cat	/i/ - /æ/	medial	.950
bout-boat	/aw/ - /ow/	medial	.967
wyle-wail	/ay/ - /ey/	medial	.967
east-iced	/iy/ - /ay/	initial	.967
ball-bill	/ɔ/ - /i/	medial	.967
pit-put	/i/ - /u/	medial	.967
way-we	/ey/ - /iy/	final	.967
round-ruined	/aw/-- /uw/	medial	.967
ill-all	/i/ - /ɔ/	initial	.967
fought-foot	/a/ - /u/	medial	.967
soup-soap	/uw/ - /ow/	medial	.967
now-new	/aw/ - /uw/	final	.967
doubt-dote	/aw/ - /ow/	medial	.967
rook-rock	/u/ - /a/	medial	.983
sly-sleigh	/ay/ - /ey/	final	.983
tea-tie	/iy/ - /ay/	final	.983
ear-or	/i/ - /ow/	initial	.983
took-talk	/u/ - /a/	medial	.983
mean-main	/iy/ - /ey/	medial	.983
elder-older	/e/ - /ow/	initial	.983
black-block	/æ/ - /a/	medial	.983
hall-hill	/ɔ/ - /i/	medial	.983
air-are	/e/ - /a/	initial	1.000

again raises the suggestion of "length" as being an aid to the auditory discrimination of syllable nuclei speech sounds.

Of the ten simple syllable nuclei speech sound contrasts in the least difficult items, seven sound contrasts involve two speech sounds in which both tongue position and tongue height vary. The result would be more difference in the vowel speech sound "quality" than would be found when tongue position and/or tongue height remained the same for the articulation of the two vowel sounds. The difference in "quality" would make for less difficulty in auditorially discriminating the vowel speech sound.

It was noted that there were no items in the least difficult word-pairs where the syllable nuclei speech sound being tested was in an unaccented part of a word. It appears that the unique auditory characteristics of each syllable nuclei speech sound are most pronounced in an accented syllable. The stress given to a particular part of a word during its pronunciation will alert a listener to that part of the word. Perhaps the increased attention to a stressed portion of a word, in which a syllable nuclei speech sound is centered, would aid in the ability to note auditory characteristics which serve as a clue to discrimination.

The phonological environment of the syllable nuclei speech sounds may have been an aid to correct auditory

discrimination. In the list of least difficult items nine of the twenty-eight word-pairs would have been previously classified as "easy" word-pairs because the consonant speech sounds surrounding the syllable nuclei were speech sounds which kindergarten children found easy to auditorially discriminate (Oberg, 1970). Comparing these items with the most difficult test items it was noted that only one of thirteen word-pairs could have been previously classified as "easy". It seems reasonable to assume that in cases of difficulty in auditory discrimination, the problem may lay mainly with the syllable nuclei speech sounds, mainly with consonant speech sounds, or mainly with a combination of vowels, semivowels, and consonant speech sounds working together in units.

Table XXVII summarizes the findings relating to the type of speech sound, and the position of the speech sound in the word-pairs. The sound types which appeared to be most difficult for the sixty kindergarten children were the initial comparison /e/ - /æ/; the medial comparisons /ɔ/ - /ə/, /ɔ/ - /a/, and /æ/ - /e/; and the final comparisons /ow/ - /uw/, and /ey/ - /iy/. Those sound types which proved to be the least difficult were: the initial comparisons /e/ - /a/, /i/ - /ow/, and /e/ - /ow/; the medial comparisons /u/ - /a/, /iy/ - /ey/, /æ/ - /a/, and /ɔ/ - /i/; and the final comparisons /ay/ - /ey/.

TABLE XXVII

DIFFICULTY OF UNLIKE WORD-PAIR CONTRASTS BY POSITION OF SOUND IN WORDS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Difficulty	Initial Position	Medial Position	Final Position
Ten Most Difficult Contrasts	elude-allude /e/-/æ/	hall-hull /ɔ/-/ə/	woe-woo /ow/-/uw/
	edition-addition /e/-/æ/	wonder-wander /ə/-/a/	who-hoe /uw/-/ow/
	effect-affect /e/-/æ/	dance-dense /æ/-/e/	hay-he /ey/-/iy/
	except-accept /e/-/æ/	catch-ketch /æ/-/e/	*
	*	won-wan /ə/ - /a/	*
	*	coughing-cuffing /a/-/ə/	*
	*	send-sand /e/-/æ/	*
	*	bull-ball /u/-/ɔ/	*
	*	purse-pierce /u/-/i/	*
	*		*
Ten Least Difficult Contrasts	air-are /e/-/a/	rook-rock /u/-/a/	sly-sleigh /ay/-/ey/
	ear-or /i/-/ow/	took-talk /u/-/a/	tea-tie /iy/-/ay/
	elder-older /e/-/ow/	mean-main /iy/-/ey/	way-we /ey/-/iy/
	east-iced /iy/-/ay/	black-block /æ/-/a/	now-new /ow/-/uw/
	ill-all /i/-/ɔ/	hall-hill /ɔ/-/i/	clue-claw /uw/-/a/
	ail-oil /ey/-/oy/	boat-boot /ow/-/uw/	fly-flea /ay/-/iy/
	eel-oil /iy/-/oy/	wyle-wail /ay/-/ey/	why-way /ay/-/ey/
	at-ought /æ/-/a/	ball-bill /ɔ/-/i/	we-why /ey/-/ay/
	aced-east /ey/-/iy/	pit-put /i/-/u/	*
	*	round-ruined /aw/-/uw/	*

*Because of the small number of items in the initial and final positions, there were not enough unlike word pairs to complete all sections of this table.

Ease and Difficulty of Auditory Discrimination

Ease or difficulty of auditory discrimination may not be a result of one particular cause working alone, but rather a number of different factors operating together to strengthen or weaken an individual's ability to discriminate a particular speech sound in words.

Two such factors are position and stress. It was noted that, in all cases where syllable nuclei were compared in the final word position, the stress fell where the syllable nuclei were located. The result may have been that the children in the test sample attended more closely to that part of the word which contained the contrasts of syllable nuclei. This indicates that the children may have used stress as an aid to discrimination of the speech sounds.

Another factor is phonological environment. An examination of Table XXVII indicated that within positions of sounds in words some speech sound contrasts were noted as being among both the most and least difficult word-pairs. In the final word position it was noted that the /ey/ - /iy/ contrast was among the most and least difficult word-pairs. Because the syllable nuclei speech sound contrast was the same in both instances, it may have been the consonant speech sound preceding the syllable nuclei which affected discrimination of the speech sounds. It may have been this phonological environment of the syllable nuclei speech

sound which affected its discriminability.

The factor of stress was also noted when consideration was given to the like word-pairs, which were noted as causing less difficulty than the unlike word-pairs, it was noted that none of the like word-pairs had syllable nuclei speech sounds in unstressed parts of the words. The children may have attended more closely to the portions of the words in which the syllable nuclei fell and as a result found the like word-pairs less difficult than the unlike word-pairs to auditorially discriminate.

CORRELATIONAL ANALYSIS

Because recent research has not been conclusive in its findings regarding the relationship between intelligence and chronological age, and auditory discrimination ability these relationships were examined in this study. Total test scores on The Vowel and Semivowel Auditory Discrimination Test were correlated with the mental and chronological ages, in months, of each child. These correlations are shown in Table XXVIII.

TABLE XXVIII

CORRELATIONS OF VARIABLES WITH CHILDRENS' SCORES ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Pupil Age	Auditory Discrimination
Mental Age	.431*
Chronological Age	.154

*Significant at the .01 level for a two-tailed test where r = .255 (Ferguson, 1959:315).

An examination of Table XXVIII indicates that there was a significant positive correlation between mental age and auditory discrimination ability. There was also a low positive correlation between chronological age and auditory discrimination ability, although this was not significant. The results of this data analysis suggest that the children, in this study, with higher intelligence performed significantly better on the auditory discrimination instrument, than the pupils with lower intelligence. The common element which may be operating on both the intelligence test scores and the auditory discrimination test scores may be the attention factor. The children who closely attended to the directions and particular task at hand on the intelligence test may have been the children who were more alert during the presentation of the word-pairs on The Vowel and Semivowel Auditory Discrimination Test. Wepman (1960:321) has suggested that a child with high intelligence attends to his task better and consequently his performance on a word-pairs auditory discrimination test is better.

ANALYSIS OF VARIANCE

An analysis of variance was used to examine the differences in performance on The Vowel and Semivowel Auditory Discrimination Test. Differences in performance between the high auditory discrimination ability and the

low auditory discrimination ability groups, and between boys and girls were examined using an analyses of variance.

Differences in Performance by High and Low Auditory Discrimination Ability Groups

Table XXIX shows the mean scores of the high ability and low ability subjects, the degrees of freedom, t values, and significance. For the purposes of analysis the high ability group were those children who obtained approximately the highest 20 per cent of the scores on the auditory discrimination test. There were eleven children in this category. The low ability group consisted of thirteen children who, according to the Test 06 computer program at the University of Alberta, represented the bottom 20 per cent of the total sample scores.

As shown in Table XXIX there was a significant difference between the high ability and low ability groups in their scores on subtests measuring sounds in the initial, medial, and final positions in word-pairs. The differences were significant at the .01 level.

There was a significant difference between the high and low ability groups on subtests measuring sounds in like, and in unlike word-pairs on The Vowel and Semivowel Auditory Discrimination Test. The differences between the scores of the high and low ability groups were significant at the .01 level.

TABLE XXIX

COMPARISONS BETWEEN HIGH AND LOW ABILITY GROUPS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Subtests of Items on The Vowel and Semivowel Discrimination Test	No. of Items	High Ability Group Mean	Low Ability Group Mean	Degrees of Freedom	t	Significance
Position of Sound in Word						
Initial	21	18.91	15.92	22	5.286	.000*
Medial	76	71.27	58.85	22	9.728	.000*
Final	18	18.00	14.85	22	4.839	.000*
Like and Unlike Word-Pairs						
Like Word-Pairs	38	37.55	35.15	22	2.879	.008*
Unlike Word-Pairs	77	70.64	54.46	22	10.786	.000*
Easy and Hard Word-Pairs						
Hard Word-Pairs	80	73.82	60.46	22	13.796	.000*
Easy Word-Pairs	35	34.36	29.15	22	7.329	.000*
Tongue Position Contrasts						
Front-Central	10	9.27	6.92	22	6.155	.000*
Central-Back	9	7.45	6.62	22	2.159	.042**
Front-Back	8	8.00	6.46	22	4.842	.000*
Tongue Height Contrasts						
High-Mid	6	5.45	3.00	22	5.651	.000*
Mid-Low	19	13.36	8.46	22	6.284	.000*
High-Low	13	12.73	10.54	22	5.416	.000*
Speech Sound Contrasts						
/iy/-/ey/	7	6.55	4.31	22	5.526	.000*
/iy/-/ay/	6	6.00	5.23	22	2.328	.029**
/ey/-/ay/	3	3.00	2.08	22	3.198	.004*
/ow/-/aw/	3	2.91	2.69	22	1.042	.308
/aw/-/uw/	3	3.00	2.69	22	1.613	.120
/ow/-/uw/	4	3.91	2.69	22	5.028	.000*

* Significant at the .01 level for a two-tailed test where t=2.819 (Ferguson, 1959: 308).

**Significant at the .05 level for a two-tailed test where t=2.074 (Ferguson, 1959: 308).

On items testing discrimination of both "easy" and "hard" word-pairs the scores of the high and low ability groups differed significantly at the .01 level of significance.

There was a significant difference at the .01 level between the high and low ability groups on the front-central, and front-back tongue position speech sound contrasts. The central-back tongue position speech sound contrasts showed a significant difference at the .05 level between the high and low ability groups. When consideration is given to tongue height speech sound contrasts it was found that for all contrasts the difference between the high ability group and the low ability group reached the .01 level of significance.

An examination of the complex syllable nuclei speech sound contrast subscores shows that, between those children high in auditory discrimination ability and low in auditory discrimination ability, the differences in their subtest scores measuring the /iy/ - /ey/, /ey/ - /ay/, and /ow/ - /uw/ contrasts were significant at the .01 level. Differences in scores on the /iy/ - /ay/ speech sound contrasts reached the .05 level of significance. There appeared to be no significant differences between the ability groups on the subtest scores on items measuring the /ow/ - /aw/ and the /aw/ - /uw/ speech sound contrasts. The reason for the lack of significant differences between

the high and low ability groups on these contrasts may be that for each contrast the words representing it would all have been classified as "hard" on the basis of phonological environment, the sound contrasts were tested only in the medial position in each case, the stress always fell on the area of the word in which the syllable nuclei were located, and the contrasts were tested only three times in each case. With only three unlike word-pair items testing these contrasts, the lack of significant differences may have occurred by chance quite easily.

As previously noted, factors which may contribute to success or failure in making auditory discriminations may be phonological environment, stress, length of syllable nuclei speech sound, quality of syllable nuclei speech sound, position of syllable nuclei speech sounds in words and similarity of tongue position in the production of syllable nuclei speech sounds.

Differences in Pupil Performance Due to Sex of the Children

The Anov. 10 computer program was run at the University of Alberta in order to determine whether any significant difference existed between the scores of the boys and girls on The Vowel and Semivowel Auditory Discrimination Test. The findings are summarized in Table XXX.

TABLE XXX

COMPARISON OF TEST RESULTS FOR BOYS AND GIRLS ON THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

Total Mean	Boys Mean	Girls Mean	Degrees of Freedom	t	Significance
99.80	98.37	101.23	58	-1.672	.099

As Table XXX indicates, the difference between the mean scores of the boys and girls was not significant at either the .01 or the .05 levels. Perhaps the number of common auditory and language experiences for boys and girls in a kindergarten situation has served to lessen the differences between sexes in these areas.

SUMMARY OF THE CHAPTER

Although kindergarten children do not seem to have any glaring difficulties with discrimination of syllable nuclei speech sounds they do not have total command of this ability. The final position appears to be the easiest position in which kindergarten children can discriminate syllable nuclei speech sounds. "Easy" word-pairs cause less difficulty than "hard" word-pairs for the kindergarten children in this sample. Like word-pairs appear to be more easily noted than unlike word-pairs.

There is a positive correlation significant at the

.01 level between the mental ages and total auditory discrimination test scores for the kindergarten children in this sample. The correlation between chronological age and total auditory discrimination test score was not significant at either the .01 or .05 levels. There is a significant difference between the high and low ability groups on all but two speech sound contrasts. There appears to be no significant difference between the scores of the boys and the scores of the girls in the test sample on The Vowel and Semivowel Auditory Discrimination Test.

The relative difficulty or ease when speech sounds are discriminated may not be attributable to one factor such as the position of the speech sound in the word. Rather it appears that a number of different variables working together may result in the ease or difficulty with which auditory discriminations may be made.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

Skill in auditory discrimination requires that the individual be able to distinguish between individual speech sounds. Once he is able to do this, the learning of phoneme-grapheme associations in the acts of learning to read well is more easily facilitated. The major purpose of this study was to examine the ability of kindergarten children to discriminate selected syllable nuclei speech sounds.

This chapter will present a summary of the findings of the study. On the bases of the findings of this research project, conclusions, implications for the teaching of reading, and recommendations for further research will be made.

SUMMARY OF THE STUDY

The overall population consisted of all kindergarten children attending school in the city of Edmonton, Alberta. From a test population of 142 children attending the four kindergartens used in the study a test sample of sixty children, thirty boys and thirty girls, was randomly selected. Twenty children were selected from each of the high, middle, and low socio-economic status groups.

An individual audiometric screening test was given to the children in the test sample. As a result of the auditory acuity screening, four children were eliminated from the study on the basis of deficient hearing.

Mental age scores were determined for each child through the administration of the Level O form of the California Short-Form Test of Mental Maturity (1963). Information regarding chronological age of the subjects was provided by the kindergarten teachers.

The ability to auditorially discriminate speech sounds was tested by The Vowel and Semivowel Auditory Discrimination Test which was constructed by the investigator. This test consisted of 115 word-pairs of which seventy-seven were unlike and thirty-eight were alike. In order to provide for consistency of presentation the test items were taped.

The data were processed using computer services at the University of Alberta during the month of June, 1970, and included an item analysis, computations of correlation coefficients, and analysis of variance.

MAIN FINDINGS OF THE STUDY

When consideration is given to the hypotheses stated in the first chapter, the findings are as follows:

Null Hypothesis 1

Between kindergarten children high in auditory

discrimination ability, and low in auditory discrimination ability, as measured by the total test scores on The Vowel and Semivowel Auditory Discrimination Test, there will be no significant difference in their:

(a) subtest scores on items measuring sounds in the initial, medial, and final positions in words;

(b) subtest scores on items measuring like and unlike word-pairs;

(c) subtest scores on items measuring "hard" and "easy" word-pairs;

(d) subtest scores on test items measuring the following sound type contrasts of syllable nuclei in words:

(i) front-central tongue position contrasts,

(ii) central-back tongue position contrasts,

(iii) front-back tongue position contrasts,

(iv) high-mid tongue height contrasts,

(v) mid-low tongue height contrasts,

(vi) high-low tongue height contrasts;

(e) subtest scores on items measuring the following speech sound contrasts of syllable nuclei:

(i) /iy/ - /ey/,

(ii) /iy/ - /ay/,

(iii) /ey/ - /ay/,

(iv) /ow/ - /aw/,

(v) /aw/ - /uw/,

(vi) /ow/ - /uw/.

The differences between the high ability and low ability groups in auditory discrimination were tested using t-tests. The results show:

(1) That hypothesis 1 (a) was rejected. There were significant differences between the subtest scores on items measuring sounds in initial, medial and final positions in words.

(2) That hypothesis 1 (b) was rejected. There were significant differences between subtest scores on items measuring like and unlike word-pairs.

(3) That hypothesis 1 (c) was rejected. There were significant differences between subtest scores measuring "hard" and "easy" word-pairs.

(4) That hypothesis 1 (d) was rejected. There were significant differences between the subtest scores on items measuring the various tongue position and height contrasts.

(5) That hypothesis 1 (e) was rejected for sections i, ii, iii, and vi, and was upheld for sections iv and v. There were significant differences between subtest scores measuring the /iy/ - /ey/, /iy/ - /ay/, /ey/ - /ay/, and the /ow/ - /uw/ speech sound contrasts. There were no significant differences between subtest scores measuring the /ow/ - /aw/ and the /aw/ - /uw/ speech sound contrasts.

Null Hypothesis 2

> There will be no significant correlation between the ability of kindergarten children to auditorially discriminate selected vowels and semivowels, as measured by The Vowel and Semivowel Auditory Discrimination test, and the following variables:

(a) mental age in months;

(b) chronological age in months.

According to the data analyzed using computer services, there was a low positive correlation between the mental age of the children in the sample and their scores on The Vowel and Semivowel Auditory Discrimination Test. The correlation of .431 was significant at the .01 level and therefore hypothesis 2 (a) was rejected. There was no significant correlation between chronological age and auditory discrimination ability of the kindergarten children, therefore hypothesis 2 (b) was upheld.

Null Hypothesis 3

> In analyzing total auditory discrimination scores on The Vowel and Semivowel Auditory Discrimination Test there will be no significant difference between the scores of the boys and the scores of the girls.

The difference between the mean scores of the boys and the girls was not significant at the .05 level therefore hypothesis 3 was upheld.

CONCLUSIONS

From the findings of this study the following conclusions are drawn subject to similarity of pupil groups and test instruments:

(1) The ability of kindergarten children to discriminate syllable nuclei speech sounds does not appear to be fully developed at a point in time just prior to beginning

grade one the following term.

(2) Chronological age is not a good indicator of discrimination ability of syllable nuclei speech sounds in cases where the ages of the children are within approximately a range of five to six years.

(3) Although mental age may be an indicator of ability in auditory discrimination of syllable nuclei speech sounds, sex is not a good indicator.

(4) Important factors in kindergarten childrens' auditory discrimination ability of syllable nuclei speech sounds appear to be the positions of these sounds in words, the location of the stress in the word, the length of the syllable nuclei speech sound, the place of articulation and use of articulators, and the phonological environment which surrounds the syllable nucleus in the word being examined. These factors may operate separately or in combination to affect discrimination of speech sounds.

(5) The perception of similarities among syllable nuclei speech sounds is easier than the perception of their differences.

(6) Some kindergarten children do not have adequate auditory acuity.

IMPLICATIONS OF THE FINDINGS

(1) Because auditory discrimination of syllable nuclei speech sounds appears to be an important skill needed

in learning to read well, and because some kindergarten children do not appear to have the necessary ability to make auditory discriminations between syllable nuclei, their auditory discrimination ability should be carefully assessed by teachers and auditory training programs initiated where needed.

(2) Teachers should be familiar with the administration of a number of auditory discrimination measures in order to determine special needs of pupils. Preservice and inservice training sessions for teachers might focus on the selection and administration of a number of auditory discrimination tests.

(3) The materials prepared to assist the teachers with pre-reading and early reading activities often rely primarily on the visual mode of learning. More materials designed to improve the necessary basic auditory skills of reading should be placed at the disposal of teachers.

(4) Because chronological age is not significantly related to kindergarten childrens' ability to discriminate syllable nuclei speech sounds teachers should begin and maintain instruction in this area prior to the children beginning grade one the following term.

(5) Although only four of the total sample of sixty children were eliminated on the basis of deficiency in auditory acuity, each one of these four children may experience difficulties in learning to read if this

condition goes uncorrected. The need for audiometric testing is crucial for all children.

(6) If a child is having difficulty with discrimination of syllable nuclei speech sounds, these sounds might first be introduced in a stressed part of a word. Once the child has mastered the speech sound in a stressed part of a word, that speech sound might then be presented in unstressed parts of other words.

(7) Because kindergarten children appear to have difficulty discriminating speech sounds which originate from similar conditions of the articulators, perhaps the auditory discrimination of syllable nuclei speech sounds might be first introduced by examining gross differences in sound made in different areas of the mouth by different positions of the tongue. Once the children have grasped the gross auditory differences in these speech sounds, the teacher might then move to speech sounds which are articulated in the same sound production area and are therefore more similar in quality. The teacher would be moving from gross differences in sound to fine differences in sound.

(8) The teacher may consider first introducing syllable nuclei speech sounds in the final position in words with the syllable nuclei speech sound preceded by consonant speech sounds which kindergarten children have found easy to discriminate.

(9) The teacher may look to information on a child's mental age for a possible indication of that child's ability to discriminate syllable nuclei speech sounds.

SUGGESTIONS FOR FURTHER RESEARCH

(1) A longitudinal study of the development of the ability to auditorially discriminate syllable nuclei speech sounds should be undertaken as children have not mastered this ability at a time when reading instruction is about to begin.

(2) The time needed to administer an individual test of auditory discrimination is an uneconomical use of teacher time. A study might be undertaken to develop an auditory discrimination test which can be administered to groups as well as to individual children.

(3) It appears that phonological environment may be an important factor in the auditory discrimination of syllable nuclei speech sounds. A study which would investigate the nature and effect of phonological environment is needed.

(4) In order to more clearly define the relationship between articulation of speech sounds and the accurate auditory discrimination of those sounds, a more extensive study might be undertaken in order to determine whether children can correctly discriminate those speech sounds which they are capable of articulating.

(5) Because of the apparent significance of the

location of the stress in a word in the auditory discriminability of syllable nuclei, a study investigating the effect of stress in the word on the auditory discrimination of syllable nuclei could be undertaken.

(6) Because it appears that "length" of vowels may have an effect on their auditory discriminability, an extensive study which would investigate the correlation between vowel and semivowel length and success of children in auditorially discriminating these speech sounds could be undertaken.

CONCLUDING STATEMENT

The purpose of this study was to investigate the ability of kindergarten children to discriminate selected syllable nuclei speech sounds.

The findings of the present study have indicated that, contrary to previous thought, kindergarten age children have not mastered the ability to make auditory discriminations between all syllable nuclei speech sounds as measured by The Vowel and Semivowel Auditory Discrimination Test. In order to get off to a good start in learning to read, children must be able to discriminate among the syllable nuclei speech sounds.

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A P P E N D I X A

THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

PART I

Following are the directions and explanations which were given to the children in the sample prior to beginning the practice items:

Today we are going to play a game with words. In order to play this game I will give you two words at a time, and you are to tell me if the words are the same or different. If I say the word twice, that is, if the second word is exactly the same as the first word, I want you to keep your hands on your lap -- like this (demonstrate for the child). Sometimes the words will rhyme, but they are not exactly the same.

Now let us try a few word pairs for practice, to make sure you know how to play the game. (Give the examinee the practice items in Appendix A, Part II.)

PART II

The following practice items were presented to the children in order to give them some experience in the proper technique of answering the items as well as to provide a warming-up period during which they could become familiar with the rate with which the word-pair items would be presented on tape:

1. wide-wade
2. fill-fell
3. role-rule
4. swim-swam
5. coat-cut
6. took-took
7. late-late
8. dig-dog
9. move-move
10. mutt-mutt

PART III

THE VOWEL AND SEMIVOWEL AUDITORY DISCRIMINATION TEST

This instrument consisted of 115 word-pair items which were administered to each of the sixty children in the test sample. A short uniform delay was allowed to pass between the presentation of each successive word-pair, thus allowing the pupil being tested an ample but not excessive amount of time to reply to each item.

1. man-man
2. at-ought
3. hall-hull
4. wonder-wander
5. pay-pay
6. learn-learn
7. steep-stoop
8. real-rail
9. watch-watch
10. bout-boat
11. rule-rail
12. said-sad
13. blown-blown
14. freed-fried
15. quick-quick
16. leer-lure
17. boat-boot
18. wyle-wail
19. elude-allude

20. older-older
21. truck-track
22. rest-rest
23. east-iced
24. purse-pierce
25. ball-bill
26. more-moor
27. we'll-we'll
28. oat-oat
29. stir-stare
30. liar-lair
31. tray-tray
32. pit-put
33. wall-wall
34. wyle-wyle
35. real-rile
36. high-high
37. put-put
38. gall-gill
39. picked-pecked
40. boat-boat
41. why-way
42. cherry-cherry
43. rook-rock
44. leer-lair
45. way-we
46. hurt-heart
47. sung-sung
48. mutter-mutter
49. look-lack
50. couch-coach
51. air-are
52. round-ruined
53. sly-sleigh
54. except-accept

55. we-why
56. ate-ate
57. coughing-cuffing
58. eel-eel
59. one-wan
60. grub-grab
61. clue-claw
62. now-now
63. effect-affect
64. dance-dense
65. yearn-yarn
66. who-who
67. grew-grew
68. liar-liar
69. hay-he
70. will-will
71. catch-ketch
72. calm-calm
73. chair-cheer
74. kiss-cuss
75. full-fall
76. make-meek
77. tea-tie
78. ill-all
79. fought-foot
80. doubt-doubt
81. pot-pot
82. soup-soap
83. ail-oil
84. well-wall
85. ear-or
86. took-talk
87. ear-ear
88. woe-woo
89. end-end

90. ranch-ranch
91. who-hoe
92. fly-flea
93. eel-oil
94. mean-main
95. ball-ball
96. crust-crossed
97. out-out
98. aced-east
99. elder-older
100. pea-pea
101. edition-addition
102. nick-neck
103. peppy-peppy
104. bout-boot
105. list-list
106. black-block
107. now-new
108. kit-cat
109. send-sand
110. bull-ball
111. doubt-dote
112. eat-eat
113. raft-ruffed
114. pup-pop
115. hall-hill

A P P E N D I X B

THE CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY, LEVEL O (1963)

1963 S-FORM LEVEL 0

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

DEVISED BY ELIZABETH T. SULLIVAN, WILLIS W. CLARK, AND ERNEST W. TIEGS

TO THE TEACHER:

Before permitting the children to open their booklets, see that each child's name, age, school, and other information are filled in on the back cover. Encourage the children to do as many items in the test as they can.

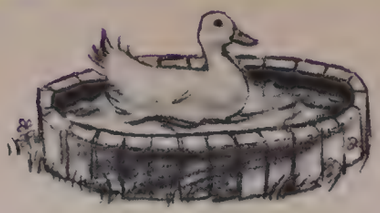
14TH PRINTING

CTB PUBLISHED BY CALIFORNIA TEST BUREAU/A DIVISION OF McGRAW-HILL BOOK COMPANY, DEL MONTE RESEARCH PARK, MONTEREY, CALIFORNIA

TEST 1

1



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TEST 1 SCORE
(number right) . . .

TEST 2

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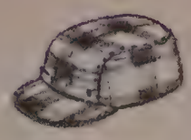


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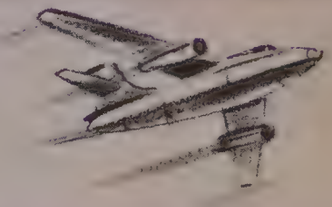

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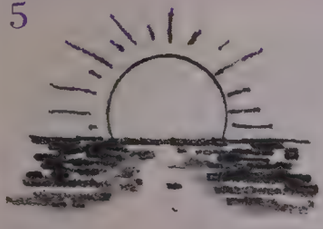



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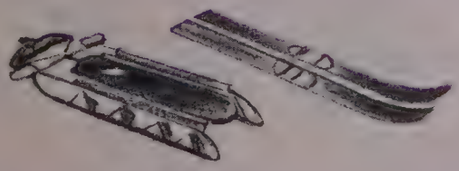


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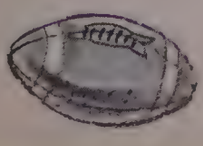



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TEST 3

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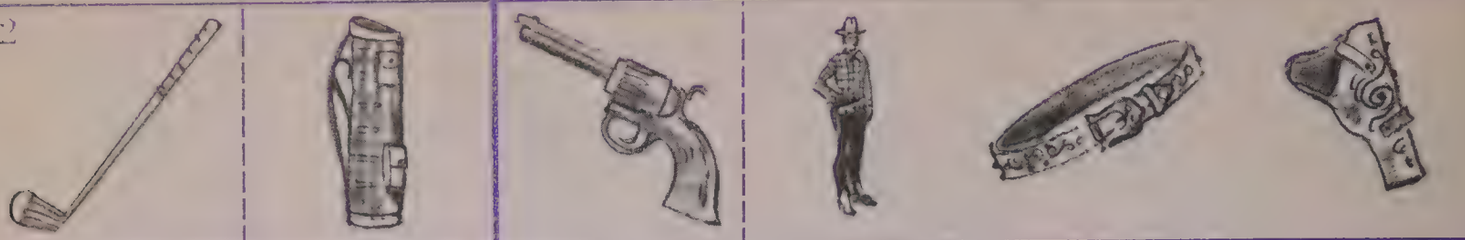

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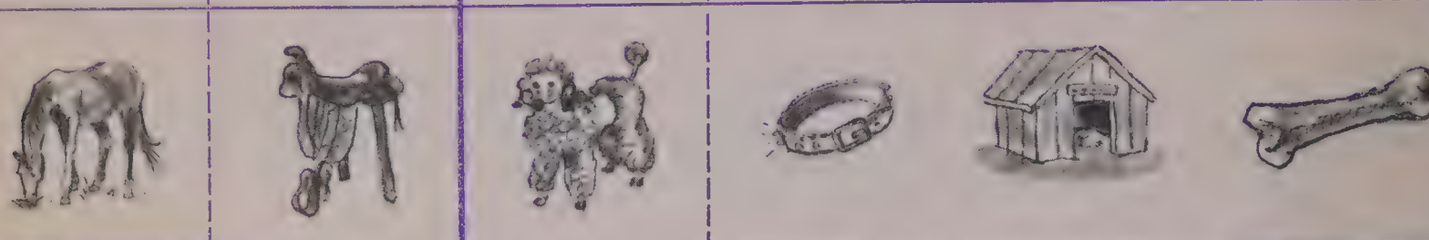

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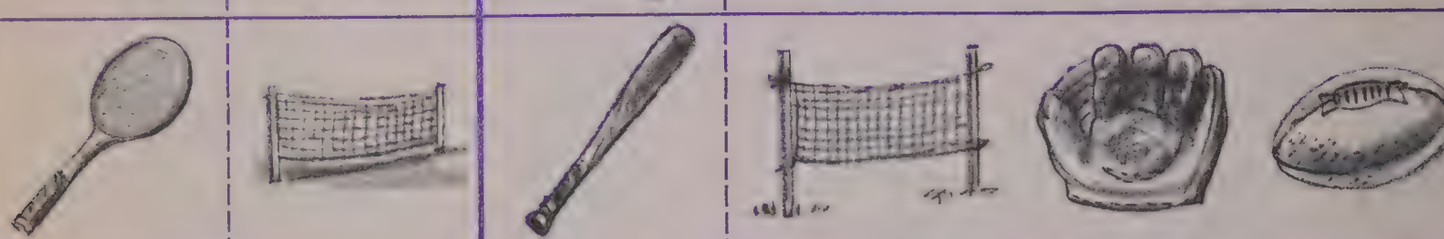

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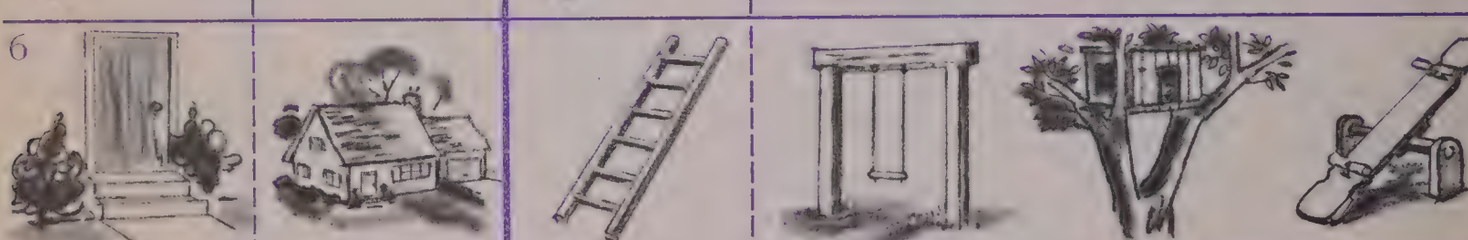

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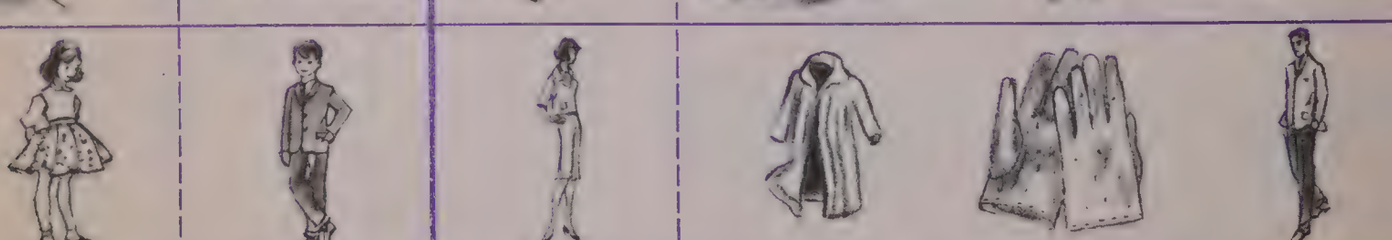

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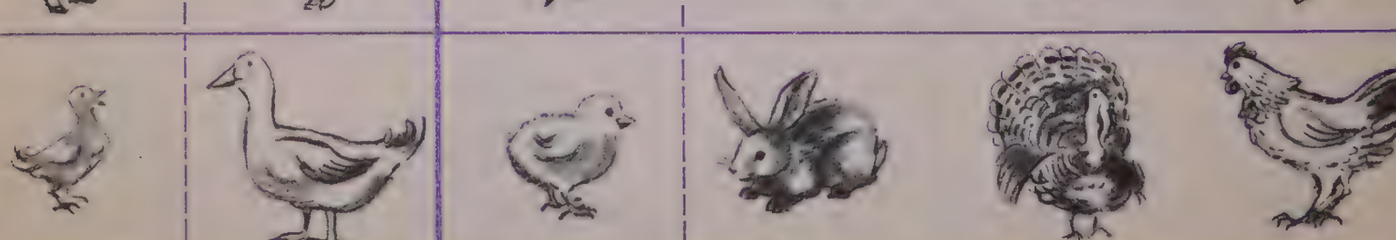

TEST 3 SCORE
(number right) . . .

TEST 4

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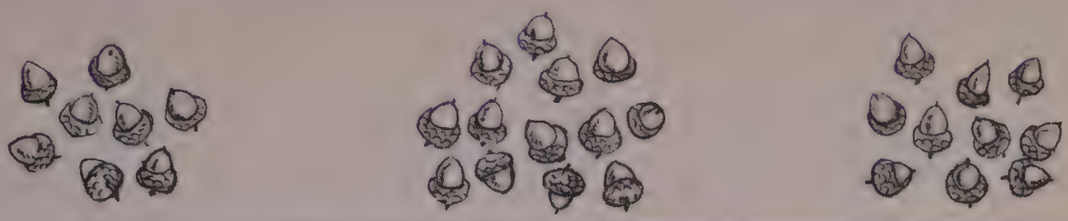

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TEST 4 SCORE
(number right) . . .

TEST 5

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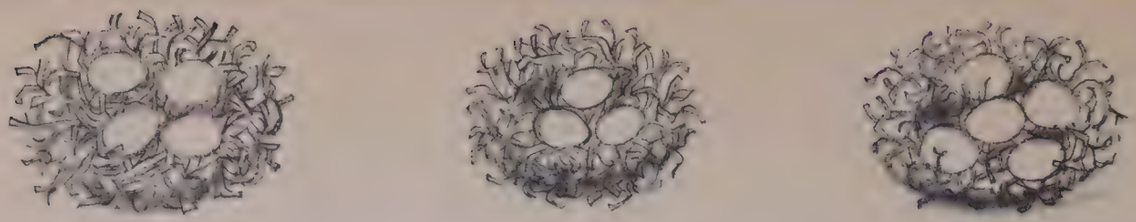

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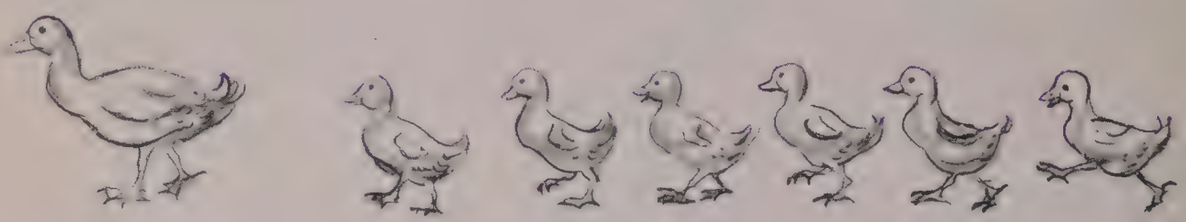

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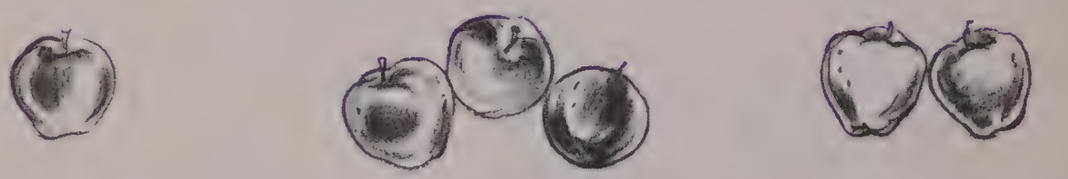

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TEST 5 SCORE
(number right) ...

TEST 6

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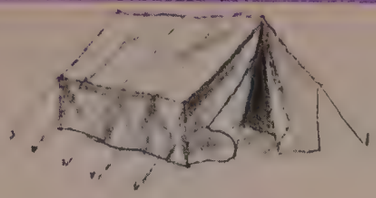


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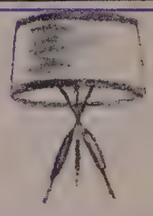

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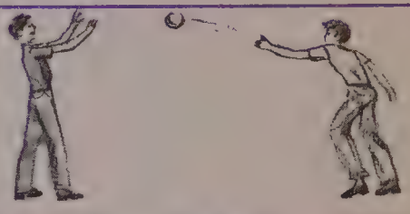

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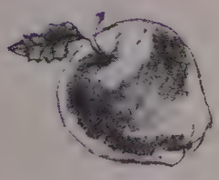

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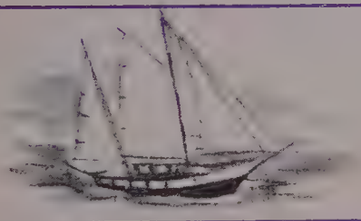

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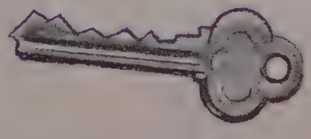


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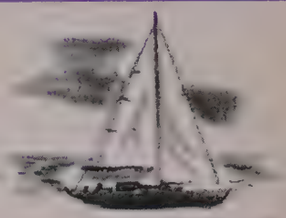

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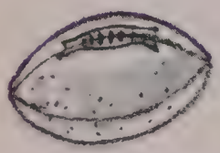

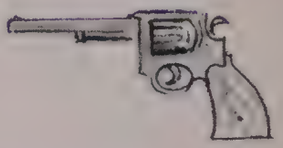

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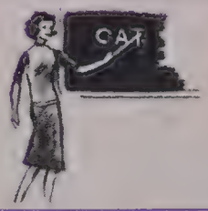

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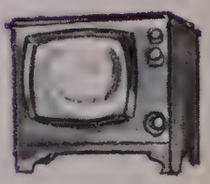

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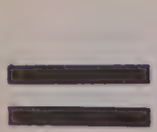

TEST 7

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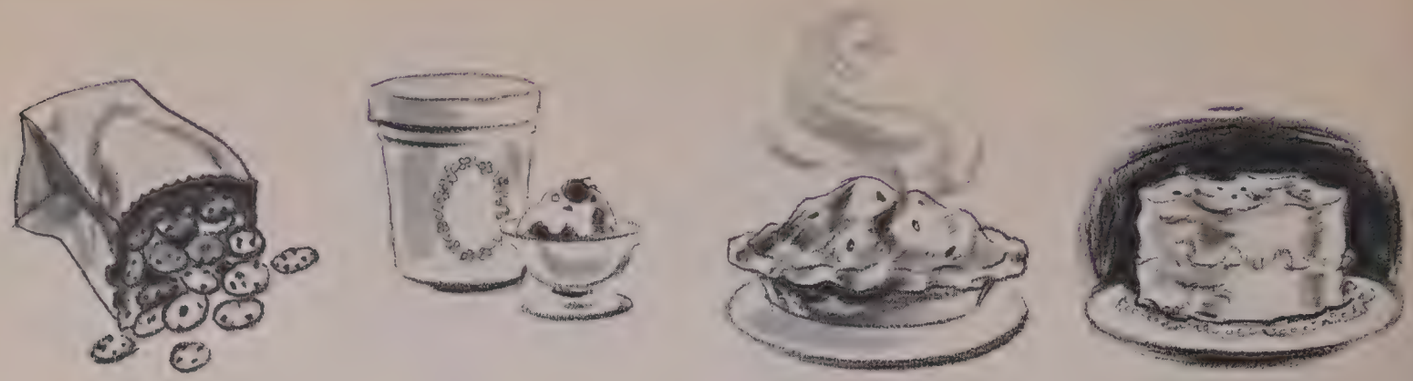

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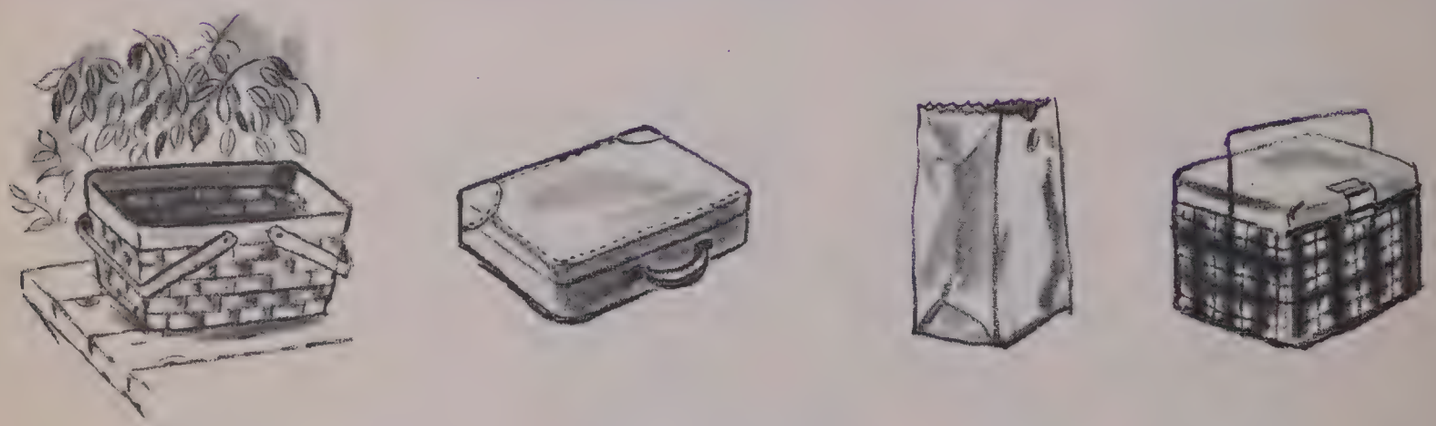

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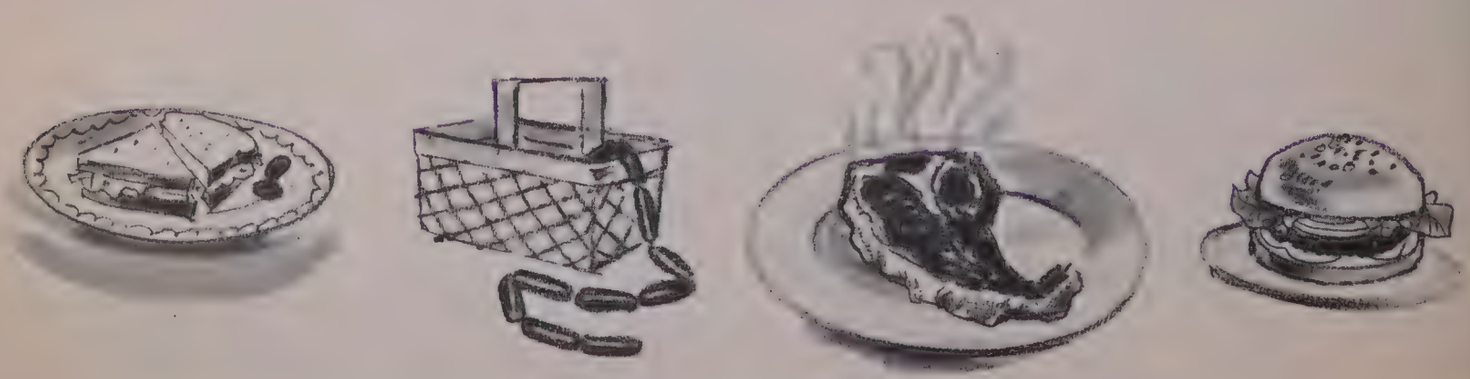

TEST 7 SCORE (number right) . . .

CALIFORNIA SHORT-FORM TEST OF MENTAL MATURITY

1963 S-FORM / LEVEL 0

DEVISED BY E. T. SULLIVAN, W. W. CLARK, AND E. W. TIEGS

Name ..... (Last / First / Middle)

School ..... City .....

Boy Girl (Circle one) Grade ..... Teacher or Examiner .....

Date of Test ..... (Year / Month / Day)

Date of Birth ..... (Year / Month / Day)

C.A. ..... ( ) (Years / Months / Total Mos.)

TEST / FACTOR	1. OPPOSITES	2. SIMILARITIES	3. ANALOGIES	I. LOGICAL REASONING	4. NUMERICAL VALUES	5. NUMBER PROBLEMS	II. NUMERICAL REASONING	III. VERBAL CONCEPTS (6. VERBAL COMPREHENSION)	IV. MEMORY (7. DELAYED RECALL)	LANGUAGE (Tests 5, 6, 7)	NON-LANGUAGE (Tests, 1, 2, 3, 4)	TOTAL	I.S.I.†
POSSIBLE SCORE	7	8	8	23	8	7	15	18	8	33	31	64	
RAW SCORE													ACTUAL G.P.
PERCENTILE*													GRADE C.A.

	LANGUAGE	NON-LANGUAGE	TOTAL	
				M.A.‡
				RAW SCORE
				I.Q.‡

STANDARD SCORE: 73, 70, 66, 65, 60, 55, 50, 45, 40, 35, 34, 30, 27

PERCENTILE RANK: 99, 98, 95, 84, 70, 60, 50, 40, 30, 16, 5, 2, 1

STANINE: 9, 8, 7, 6, 5, 4, 3, 2, 1

INTELLIGENCE QUOTIENT: 137+, 132, 126, 120, 116, 112, 108, 104, 100, 96, 92, 88, 84, 80, 74, 68, 63–

*Unless otherwise indicated, national norms appropriate for pupil's chronological age are used.

†Intellectual Status Index; see Manual.

‡Must be obtained from table in Manual.